The Journal of Parasitology

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# PROGRAM AND ABSTRACTS OF THE SEVENTEENTH ANNUAL MEETING OF THE AMERICAN SOCIETY OF PARASITOLOGISTS

## DALLAS, TEXAS

## DECEMBER 29, 30 and 31, 1941

## PROGRAM[1]

MONDAY MORNING SESSION, DECEMBER 29, 9:30 A.M.; ROOM G, FIRST METHODIST CHURCH, ROSS AVENUE AND HARWOOD STREET.

*Read*

1. Development of the Excretory System in Cercariae of Digenetic Trematodes. (10 min) (Lantern) KATHLEEN L. HUSSEY, Colorado College.

2. The Excretory System of *Paragonimus*. (8 min) (Lantern) ELON E. BYRD, University of Georgia.

3. Preliminary Report on *Echinochasmus* sp. (Trematoda), and a Comparison of the Excretory System of the Cercaria with Three Related Species. (10 min) (Lantern) (Also by demonstration) ELSIE W. TOWNSEND, Wayne University.

4. The Designation of Type Specimens in Describing New Species. (5 min) ALLEN MCINTOSH, U. S. Bureau of Animal Industry.

5. Studies on Cercariae of the Common Mud-flat Snail, *Cerithidea californica*. I. The Pleurolophocercous Groups. (15 min) (Lantern) WANDA SANBORN HUNTER, University of California at Los Angeles.

6. The Early Developmental Stages of *Plagiorchis muris* (Trematoda: Plagiorchiidae) in Its First Intermediate Host. (15 min) (Lantern) W. W. CORT, Johns Hopkins University, AND LOUIS OLIVIER, U. S. Bureau of Animal Industry.

7. The Life History of *Apophallus brevis* Ransom, 1920. (15 min) (Lantern) MAX J. MILLER, Institute of Parasitology, Macdonald College, Quebec, Canada.

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[1] An alphabetical author index will be found at the end of this program.

Extra copies of this Supplement, and portraits of parasitologists, will be on sale at the meeting.

8. The Life History of *Podocotyle atomon* (Rudolphi) (Trematoda: Opecoelidae). (10 min) (Lantern) (Also by demonstration) A. V. HUNNINEN AND R. M. CABLE, Oklahoma City University, Purdue University and the Marine Biological Laboratory.

9. Studies on the Life History of *Lecithaster confusus* Odhner (Trematoda: Hemiuridae). (10 min) (Lantern) A. V. HUNNINEN AND R. M. CABLE, Oklahoma City University, Purdue University and the Marine Biological Laboratory.

10. Studies on the Life History of *Siphodera vinaledwardsii* (Linton) (Trematoda: Cryptogonimidae). (10 min) (Lantern) (Also by demonstration) R. M. CABLE AND A. V. HUNNINEN, Purdue University, Oklahoma City University and the Marine Biological Laboratory.

11. Studies on the Life History of a Dicrocoeliid Trematode of the Genus *Lyperosomum*. (12 min) (Lantern) J. FRED DENTON, Georgia Southwestern College.

*By Title*

12. The Occurrence of *Dicrocoelium dendriticum* in the United States. EMMETT W. PRICE AND WILLIAM D. KINCHELOW, U. S. Bureau of Animal Industry.

13. *Phyllodistomum coatneyi* n. sp., a Trematode from the Urinary Bladder of *Ambystoma maculatum* (Shaw). F. G. MESERVE, Macalester College.

14. The Systematic Position of the Genus *Deropristis* Odhner with Respect to a Proposed Revision of the Trematode Families Acanthocolpidae and Allocreadiidae. R. M. CABLE AND A. V. HUNNINEN, Purdue University, Oklahoma City University and the Marine Biological Laboratory.

15. Notes on Embryonating Eggs of *Zygocotyle lunata* and on Their Preparation for Cytological Study. GABRIEL C. GODMAN AND CHARLES H. WILLEY, New York University.

16. Parasites of the Green Turtle, *Chelonia mydas* (L.), with Special Reference to the Rediscovery of Trematodes Described by Looss from This Host Species. Ross F. NIGRELLI, New York Aquarium.

17. Studies on Host-parasite Reactions. V. The Integumentary Type of Strigeid Cyst. GEORGE W. HUNTER, III, Wesleyan University, AND WANDA S. HUNTER, University of California at Los Angeles.

MONDAY AFTERNOON SESSION, DECEMBER 29, 2:00 P.M.; ROOM G, FIRST METHODIST CHURCH, ROSS AVENUE AND HARWOOD STREET.

*Read*

18. The Incidence of *Trichomonas foetus* in Wisconsin Cattle. (10 min) BANNER BILL MORGAN, University of Wisconsin.

19. The Effects of Sulfaguanidine on Experimental Bovine Coccidiosis. (15 min) (Lantern) (Also by demonstration) DONALD C. BOUGHTON, U. S. Regional Animal Disease Research Laboratory, Auburn, Ala.

20. Immunization against Coccidiosis by the Use of X-ray Attenuated Oöcysts. (15 min) (Lantern) S. H. WAXLER AND C. A. HERRICK, University of Wisconsin.

21. Hatching Ascaris Eggs in Vitro. (15 min) (Lantern) GEORGE L. GRAHAM, Rockefeller Institute for Medical Research, Princeton, N. J.

22. Some Clinical Aspects of Experimental Esophagostomiasis in Cattle. (10 min) (Lantern) JOHN S. ANDREWS, U. S. Bureau of Animal Industry.

23. The Biology and Ecology of the Snail, *Stagnicola bulimoides techella* (Hald.), Intermediate Host of *Fasciola hepatica* Linn., in South Texas. (15 min) (Lantern) O. WILFORD OLSEN, U. S. Bureau of Animal Industry.

24. Losses of *Haemonchus* Larvae Early after Their Administration to Susceptible Sheep. (15 min) (Lantern) NORMAN R. STOLL, Rockefeller Institute for Medical Research, Princeton, N. J., AND J. H. TETLEY, Massey Agricultural College.

25. The Effect of Milk Diet on the Development of *Haemonchus contortus* in Calves. (15 min) (Lantern) DALE A. PORTER, U. S. Regional Animal Disease Research Laboratory, Auburn, Ala.

26. Studies on Bovine Gastro-intestinal Parasites: VII. The Effects of a Low Plane of Nutrition (Cottonseed Hulls) on Immunity to the Stomach Worm (*Haemonchus contortus*). (15 min) ROY L. MAYHEW, Louisiana State University.

27. Further Data on the Blood Picture in Stomach Worm (*Haemonchus contortus*) Infections. (15 min) ELAINE T. DELAUNE AND ROY L. MAYHEW, Louisiana State University.

28. Notes on the Musculature of the Male Genitalia of *Haemonchus contortus*. (15 min) (Lantern) WILLIAM LOGAN THRELKELD AND M. E. HENDERSON, Virginia Agricultural Experiment Station.

*By Title*

29. Sulfaguanidine Feeding as a Control Measure for Cecal Coccidiosis of Chickens. MARION M. FARR AND REX W. ALLEN, U. S. Bureau of Animal Industry.

30. Effect of a Single Dose of Phenothiazine upon Egg Production and Viability of the Eggs of Swine Lungworms. L. A. SPINDLER AND KENNETH C. KATES, U. S. Bureau of Animal Industry.

31. Limited Tests of Phenothiazine as an Anthelmintic in Goats.

PAUL D. HARWOOD AND JAMES E. GUTHRIE, Dr. Hess and Clark Laboratories, Ashland, O.

32. Skin and Precipitin Tests for the Diagnosis of Trichina Infections in Grain-fed and in Garbage-fed Hogs. L. A. SPINDLER AND JOHN L. AVERY, U. S. Bureau of Animal Industry.

33. Reactions in Garbage-fed and in Grain-fed Hogs to Intracutaneous Injections of Various Diluents. JOHN L. AVERY, U. S. Bureau of Animal Industry.

34. Precipitate Formation around Trichina Larvae in Sera from Trichina-infected, and Trichina-free Hogs. L. A. SPINDLER, JOHN L. AVERY AND HARRY E. ZIMMERMAN, JR., U. S. Bureau of Animal Industry.

35. Experimental Infection of Pigs with the Swine Thorn-headed Worm, *Macracanthorhynchus hirudinaceus*. KENNETH C. KATES, U. S. Bureau of Animal Industry.

36. The Duration of Infectivity of Nematode Parasites of Cattle on Florida Pasture with Observations on Resistance of Calves to Natural Reinfection with *Haemonchus contortus*. DALE A. PORTER, U. S. Regional Animal Disease Research Laboratory, Auburn, Ala., AND LEONARD E. SWANSON AND TERRENCE J. DRAKE, University of Florida.

TUESDAY MORNING SESSION, DECEMBER 30, 9:30 A.M.; ROOM G, FIRST METHODIST CHURCH, ROSS AVENUE AND HARWOOD STREET.

*Read*

37. The Occurrence of Mites in Pinnipeds, including a New Species from the California Sea-lion, *Zalophus californianus*. (10 min) (Lantern) (Also by demonstration) WILLIS H. DOETSCHMAN, University of Southern California and Biological Research Institute, Zoological Gardens of San Diego.

38. Observations on the Duration of an Infection of *Hymenolepis nana* in Man. (10 min) (Lantern) WILLIAM HUGH HEADLEE, Purdue University.

39. The Effect of Host Age on the Number of *Trichinella spiralis* Recovered from Rats during the Early Period of Infection. (10 min) L. O. NOLF AND HERMAN ZAIMAN, University of Iowa.

40. The Effects of Immune Serum upon the Larvae of *Trichinella spiralis* in Vitro. (15 min) (Lantern) EDWARD P. OFFUTT, JR., University of Rochester.

41. Attempted Passive Transfer to Rats and Mice of Immunity to *Trichinella spiralis*. (10 min) (Lantern) O. R. MCCOY AND FRANKLYN F. BOND, University of Rochester.

42. The Protective Action of Normal Sheep Serum against Infections of *Trypanosoma duttoni* in the Mouse. (5 min) (Lantern)

WILLIAM H. TALIAFERRO AND YELENA PAVLINOVA OLSEN, University of Chicago.

43. The Trypanocidal Action of Sheep Serum on *Trypanosoma duttoni.* (10 min) (Lantern) WILLIAM H. TALIAFERRO AND LUCY GRAVES TALIAFERRO, University of Chicago.

44. Quantitative Relationships in Immunity to Hookworm. (15 min) (Lantern) G. F. OTTO, Johns Hopkins University.

TUESDAY MORNING, DECEMBER 30, 11:00 A.M.; ROOM G, FIRST METHODIST CHURCH, ROSS AVENUE AND HARWOOD STREET.

*Presidential Address*

45. Natural Resistance to Helminthic Infections. JAMES E. ACKERT, Kansas State College.

TUESDAY NOON, DECEMBER 30.

12:30 P.M. PARASITOLOGISTS' LUNCHEON, HOTEL BAKER.

1:30 P.M. ANNUAL BUSINESS MEETING.

TUESDAY AFTERNOON SESSION, DECEMBER 30, 3:00 P.M.; HYER HALL, SOUTHERN METHODIST UNIVERSITY. (Tea will be served.)

*By Demonstration*

3. Preliminary Report on *Echinochasmus* sp. (Trematoda), and a Comparison of the Excretory System of the Cercaria with Three Related Species. (Also read) ELSIE W. TOWNSEND, Wayne University.

8. The Life History of *Podocotyle atomon* (Rudolphi) (Trematoda: Opecoelidae). (Also read) A. V. HUNNINEN AND R. M. CABLE, Oklahoma City University, Purdue University and the Marine Biological Laboratory.

10. Studies on the Life History of *Siphodera vinaledwardsii* (Linton) (Trematoda: Cryptogonimidae). (Also read) R. M. CABLE AND A. V. HUNNINEN, Purdue University, Oklahoma City University and the Marine Biological Laboratory.

19. The Effects of Sulfaguanidine on Experimental Bovine Coccidiosis. (Also read) DONALD C. BOUGHTON, U. S. Regional Animal Disease Research Laboratory, Auburn, Ala.

37. The Occurrence of Mites in Pinnipeds, including a New Species from the California Sea-lion, *Zalophus californianus.* (Also read) WILLIS H. DOETSCHMAN, University of Southern California and Biological Research Institute, Zoological Gardens of San Diego.

46. A Case of Intestinal Myiasis. MARCUS W. LYON, South Bend Clinic, AND JOHN D. MIZELLE, University of Notre Dame.

47. *Hexamita* in the Blood of a Mouse. JUSTIN ANDREWS AND MADGE REYNOLDS, Georgia Department of Public Health.

48. Two Unusual Trematodes. H. W. MANTER, University of Nebraska.

49. Two Species of *Porrocaecum* (Nematoda) from the Robin. J. DAN WEBSTER, Rice Institute.

50. The Genus *Gnathostoma* in North America. ASA C. CHANDLER, Rice Institute.

51. Demonstration of a New Parasitic Nematode from a Water Scavenger Beetle. A. C. TODD, University of Nebraska.

53. Some Observations on *Histomonas* from Wild Pheasants and Domestic Fowls. (Also read) D. H. WENRICH, University of Pennsylvania.

62. Reservoir Hosts of Chagas' Disease in the State of Texas. (Also read) A. PACKCHANIAN, School of Medicine, University of Texas.

WEDNESDAY MORNING SESSION, DECEMBER 31, 9:30 A.M.; ROOM G, FIRST METHODIST CHURCH, ROSS AVENUE AND HARWOOD STREET.

*Read*

52. The Host-parasite Phylogenetic Complex: The Criteria and Their Application to the Opalinid-Anuran Complex. (15 min) JOHN LUTHER MOHR, University of California.

53. Some Observations on *Histomonas* from Wild Pheasants and Domestic Fowls. (15 min) (Lantern) (Also by demonstration) D. H. WENRICH, University of Pennsylvania.

54. The Pathogenicity for Kittens of *Endamoeba histolytica* from a Human Case of Acute Amoebic Dysentery. (15 min) (Lantern) CHARLES W. REES AND LUCY V. REARDON, National Institute of Health.

55. Pantothenic Acid and *Eimeria nieschulzi* Infection in the White Rat. (12 min) (Lantern) ELERY R. BECKER, Iowa State College.

56. Transmission of the Liver Coccidium, *Eimeria stiedae*, from the Domestic to the Cottontail Rabbit. (10 min) (Lantern) HARRY A. JANKIEWICZ, University of Southern California.

57. Life Cycles of Four Species of Intestinal Coccidia of the Domestic Rabbit. (15 min) (Lantern) ROBERT L. RUTHERFORD AND JOHN F. KESSEL, University of Southern California.

58. A Study of the Paroxysms Resulting from Induced Infections of *Plasmodium vivax*. (12 min) (Lantern) G. ROBERT COATNEY AND MARTIN D. YOUNG, U. S. Public Health Service.

59. Saurian Malaria. (10 min) (Lantern) CLAY G. HUFF, University of Chicago.

60. Blood-cell Counts in *Plasmodium durae* Infections. (10 min) (Lantern) CARLTON M. HERMAN AND JEANNE YOUNG, Los Angeles Wildlife Disease Research Station.

61. The Anti-malarial Effect of Acranil. (15 min) (Lantern)

WENDELL D. GINGRICH AND ROLLIN S. FILLMORE, School of Medicine, University of Texas.

62. Reservoir Hosts of Chagas' Disease in the State of Texas. (15 min) (Motion Picture) (Also by demonstration) A. PACKCHANIAN, School of Medicine, University of Texas.

*By Title*

63. The Occurrence of *Heterodoxus longitarsus* Piaget (Mallophaga; Boopinae) on Dogs in Mississippi. JAMES W. WARD, Mississippi State College.

64. Mechanical Transmission of Shope Rabbit Fibroma by Certain Haematophagous Bugs. CORNELIUS B. PHILIP, Hamilton, Montana.

65. Oxidation-reduction Potentials in Relation to the Cultivation of *Endamoeba histolytica*. LEON JACOBS, National Institute of Health.

66. Indicanuria and the Vitamin A Absorption Test in Giardiasis. C. P. KATSAMPES, W. A. PHILLIPS, A. B. MCCOORD AND S. T. HARRIS, University of Rochester. (Introduced by O. R. McCoy.)

67. Incidence of Protozoan Infection amongst the Personnel of a Large General Hospital with Special Regard to Incidence according to Race and Occupation. MAURICE M. ROTHMAN AND MARION LASKEY, University of Pennsylvania.

68. Survival Time of Intravaginally Implanted *Trichomonas hominis*. ROBERT M. STABLER, University of Pennsylvania, AND L. G. FEO, Jefferson Medical College Hospital.

69. Notes on a Microsporidian Parasite, *Duboscqia* sp., of *Reticulitermes* of Maryland. RICHARD R. KUDO, University of Illinois.

WEDNESDAY AFTERNOON SESSION, DECEMBER 31, 2:00 P.M.; ROOM G, FIRST METHODIST CHURCH, ROSS AVENUE AND HARWOOD STREET.

*Read*

70. The Fate of Some Species of Schistosome Cercariae in Chick Embryos. (10 min) (Lantern) STERLING BRACKETT AND ALBERT J. BECKMANN, University of North Carolina and University of Michigan Biological Station.

71. Studies on Host-parasite Reactions. VI. An Hypothesis to Account for Pigmented Metacercarial Cysts in Fish. (15 min) (Lantern) GEORGE W. HUNTER, III, Wesleyan University.

72. Observations on the Geographical Distribution of Digenetic Trematodes of Marine Fishes. (10 min) (Lantern) H. W. MANTER, University of Nebraska.

73. The Frequency of Helminths in Their Naturally Infected Hosts.

(15 min) (Lantern) H. F. Hsü and S. Y. Li, Peiping Union Medical College, Peiping, China. (Introduced by the Secretary.)

74. Further Studies on the North American Hirudinea. (12 min) Marvin C. Meyer, New Jersey College for Women of Rutgers University.

75. A New Species of Branchiobdellid from Kentucky. (8 min) Clarence J. Goodnight, Brooklyn College.

76. Life History and Development of *Macracanthorhynchus ingens* and *Mediorhynchus grandis* (Acanthocephala). (10 min) (Lantern) Donald V. Moore, Rice Institute.

77. An Addition to the Life History of *Leidynema appendiculatum* (Leidy, 1850) Chitwood, 1932, a Nematode Parasitic in Cockroaches. (5 min) A. C. Todd, University of Nebraska.

78. Removal of Chicken Tapeworms by Host Starvation and Some Effects of Such Treatment on Tapeworm Metabolism. (15 min) (Lantern) W. M. Reid, Monmouth College, and J. E. Ackert, Kansas State College.

79. Effect of Atabrine upon Experimental Cysticercosis of Mice. (12 min) (Lantern) James T. Culbertson and Sylvia H. Greenfield, College of Physicians and Surgeons, Columbia University.

*By Title*

80. The Life Cycle of *Dioctophyma renale*, the Giant Kidney Worm of Mammals. Arthur E. Woodhead, University of Michigan.

81. The Possibility of Chemical Control of the Snail Intermediate Hosts of *Schistosoma mansoni* in Venezuela. George W. Luttermoser, Instituto Nacional de Higiene, Caracas, Venezuela.

82. Effects of Duodenal Mucus of Dogs and Swine upon the Viability of *Ascaridia lineata* in Vitro. L. L. Eisenbrandt, University of Kansas City, and J. E. Ackert, Kansas State College.

83. The Rôle of Duodenal Mucus in Age Resistance. L. P. Frick and J. E. Ackert, Kansas State College.

84. Intestinal Resistance to a Second Infection of *Trichinella spiralis*. Arthur J. Levin and Titus C. Evans, University of Iowa.

85. Demonstration of Naturally Acquired, Passive Immunity to *Hymenolepis nana* var. *fraterna*. John E. Larsh, Jr., Johns Hopkins University.

86. Effects of Testosterone on Nematodes. Lyell J. Thomas, University of Illinois.

87. Hairworms as Parasites of Fishes. Ross F. Nigrelli, New York Aquarium.

88. Cultivation Experiments with the Avian Malaria, *Plasmodium circumflexum*. Frederick Coulston, Syracuse University.

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## ABSTRACTS

1. *Development of the Excretory System in Cercariae of Digenetic Trematodes.* KATHLEEN L. HUSSEY, Colorado College.

The study of development of the excretory system of digenetic trematodes is continued with five species, including representatives of three families not previously studied. The development of the excretory system of *Proterometra macrostoma* (Azygiidae) is like that described for cercariae of Strigeata. Two primitive tubes form, extend to the tips of the furcae, fuse to form the bladder at the posterior end of the body and anterior end of the tail, then remain separate for the rest of the length of the tail. The mature cercaria has numerous caudal flame cells. In the gasterostome cercaria *Bucephalus elegans* (Bucephalidae) early development of the excretory system follows this same plan. After formation of the bladder each caudal tube makes contact with the surface of the tail fork near its proximal end forming one pore of the mature cercaria, and original caudal pores are lost. In the cercariaeum of *Zoogonus rubellus* (Zoogonidae) the excretory system develops as in stylet cercariae and similar to the cercariaeum of *Triganodistomum mutabile* as described by Wallace (1941, Tr. Am. Micr. Soc. **60**: 322–324). Two primitive tubes extend to the posterior end of the body, fuse to form a bladder, and penetrate a mesodermal cell mass which forms the epithelial wall. Except for a much less distinct epithelial bladder wall fundament, the development of the excretory system of *Halipegus eccentricus* (Hemiuridae) is like that already described for *H. occidualis*. The development of the excretory system in *Himasthla quissetensis* (Echinostomidae) is like that of *Echinostoma revolutum* and *Petasiger nitidus*.

2. *The Excretory System of* Paragonimus. ELON E. BYRD, University of Georgia.

The excretory bladder terminates near the posterior end of the body where it communicates with the pore by an elongated, slightly muscular tube. The bladder is large and occupies a medial position in the body throughout its course, from about one-third the distance from the bifurcation of the ceca to the ventral sucker. The common collecting tubules contact the bladder between the levels of the ovary and testes and these tubules curve posteriorly, then laterally and finally anteriorly before giving rise to the anterior and posterior main tubules. Each of the anterior main collecting tubules gives rise to seven accessory tubules while each of the posterior main tubules gives rise to nine accessories. There is a decided tendency for the accessory tubules to take their origin in pairs. However, the third accessory from the anterior end of the anterior main and the third accessory from the posterior end of the posterior main tubules are single. Approximately half of the accessory tubules, one member of each pair, turns ventrally while the other member of the pair turns dorsally, and these supply the capillary tubules and flame cells for the dorsal and ventral aspects of the body. Each accessory tubule terminates by giving rise to three capillary tubules, each of which ends in a more or less stellate-shaped flame cell. Thus the formula for the excretory pattern is: $2[(3+3+3+3+3+3+3)+(3+3+3+3+3+3+3+3+3+3)]=96$ flame cells.

3. *Preliminary Report on* Echinochasmus *sp. (Trematoda), and a Comparison of the Excretory System of the Cercaria with Three Related Species.* ELSIE W. TOWNSEND, Wayne University.

The cercaria of *Echinochasmus* sp. was found in *Goniobasis livescens* collected from Douglas Lake, Michigan, and several localities along the Huron River near Ann Arbor, Michigan. This large-tailed echinostome cercaria is an active swimmer and acts as attractive bait to two species of dace and several species of minnows of the genus *Notropis*. In the fish host the metacercariae are found in ovoid thin-walled cysts embedded in the base of the gills. The collar spines begin

to appear in four or five days. Metacercariae are infective in 28 days, and when fed to domestic ducks develop to maturity in the small intestine. Maturity is reached in five to seven days. The small adult fluke has a single row of 22 collar spines interrupted dorsally by a space the width of the oral sucker. A study of the excretory system was made from the developmental stages of the cercaria beginning with the early embryo. As the tail develops the primary tubes are carried along and open laterally near the tip. The primary tubes fuse in the bladder region and in the tail. The bladder forms a body chamber and a tail reservoir. When the lateral excretory pores are established at the base of the tail, the caudal canals gradually become suppressed.

4. *The Designation of Type Specimens in Describing New Species.* ALLEN MCINTOSH, U. S. Bureau of Animal Industry.

An examination of taxonomic papers published by members of the American Society of Parasitologists and others reveals a lack of uniformity in terminology when designating type specimens of new species. Frizzell (1933, Am. Midland Naturalist **14**: 637–668), listing over 200 terms for type designations, called attention to this common fault of taxonomists. In some papers authors designate as *types* all specimens examined in the preparation of a species description; some designate only *cotypes;* an occasional author may designate *cotypes* and *paratypes* for a single species; and in proposing several new species in a single paper one author designated only *cotypes* for some species and *type* and *paratypes* for the remaining ones. Of common occurrence are papers having no designation of types. Every proposed new species or subspecies should be fixed by being anchored to a single *type* specimen. If the species is based on several specimens, having no single specimen designated as *type,* there is a chance that the lot of specimens may represent more than one species, thus creating confusion as to the status of the species originally proposed. Both confusion and lack of uniformity may be avoided by following the recommendations given in the second paragraph of Appendix "A" of the International Rules of Zoological Nomenclature, which is as follows: "It is recommended that in published descriptions of a new species or new subspecies, only one specimen be designated and labeled as *type,* the other specimens examined by the author at the same time being *paratypes.*"

5. *Studies on Cercariae of the Common Mud-flat Snail,* Cerithidea californica. *I. The Pleurolophocercous Groups.* WANDA SANBORN HUNTER, University of of California at Los Angeles.

*Cerithidea californica,* which is a characteristic inhabitant of the mud flats of southern California, acts as host for a large variety of cercariae. The pleuro- and parapleurolophocercous groups were found to include approximately 27 per cent of the total infection found in several large collections. The highest seasonal incidence for these groups comes in April and is coincident with the highest general infection. Although June is the low point for general infection, these groups comprised over 50 per cent of all of the types of cercariae found. It is believed that there are at least five different cercariae present in the author's collection from this host which belong to the Superfamily Opisthorchioidea. Methods of differentiating these species to facilitate later studies are being worked out. The excretory pattern cannot be used easily as a criterion in identifying them. Specific larval characters such as the number of penetration glands, the arrangement of the caudal finfolds, body proportions and especially the living habits must be relied upon.

6. *The Early Developmental Stages of* Plagiorchis muris *(Trematoda: Plagiorchiidae) in Its First Intermediate Host.* W. W. CORT, Johns Hopkins University, AND LOUIS OLIVIER, U. S. Bureau of Animal Industry.

Later stages of mother sporocysts of *P. muris* are oval, disc-shaped masses (0.5–1.7 mm), composed almost entirely of daughter sporocyst embryos (about 300

to 500 in each) attached to the outside of the snail's intestine. The matrix surrounding the embryos consists of irregular cells with no obvious organization. In earlier stages tubules composed of these cells can be made out enclosing linear series of the embryos. These same cells also form an outer covering for each daughter sporocyst, the "paletot" of earlier workers. The largest daughter sporocysts still found in the mother sporocyst masses are elongate and mobile, and contain cercarial embryos of different ages and a single discrete germ mass. When the mother sporocyst breaks up the daughters migrate along the ducts and vessels to all parts of the digestive gland of the snail. They then become attached, thicken, and appear crowded with embryos. Thickened areas of the true sporocyst wall are formed at their ends and from them protrusions push out. Further growth of these protrusions and the pushing into them of cercarial embryos produce a variety of irregularly shaped sporocysts, each loosely enclosed in the "paletot." Later, with increasing size and rapid growth of the cercarial embryos the shapes of the sporocysts become less irregular. Growth continues after the escape of the first mature cercariae, and later the outer layer becomes pigmented. The germ masses persist throughout the whole life of the daughter sporocysts, and are found still apparently producing new cercarial embryos in the oldest sporocysts from old snails.

7. *The Life History of* Apophallus brevis *Ransom, 1920.* MAX J. MILLER, Institute of Parasitology, Macdonald College, Quebec, Canada.

A re-study of the morphology of *Apophallus imperator* Lyster, 1940, and *A. brevis* Ransom, 1920, shows the two species to have no constant differences of specific importance. The appearance of the gonotyle, which Lyster used as a character to separate these species, cannot be accepted as sufficiently significant or constant to be of specific importance. *A. imperator,* therefore, falls as a synonym of *A. brevis.*

Studies on the life history of *Apophallus brevis* in Quebec, Canada, have incriminated the small operculate snail, *Amnicola limosa,* as the first intermediate host. The second intermediate host has been found in nature to be the speckled trout (*Salvelinus fontinalis*). The metacercariae encyst in the skin, forming a black pigmented cyst. These cysts have never been found in the muscle tissue. The metacercariae become infective to the definitive host within 3 to 4 weeks. Speckled and brown trout have been infected experimentally. Rainbow trout, however, are refractory to infection. The metacercariae will develop to an adult stage in pigeons and kittens, under experimental conditions, in from 2 to 7 days. Ransom found adult *A. brevis* in the California gull. However, in Quebec the normal host in nature has been shown to be the loon (*Gavia immer*). Young loons were successfully infected experimentally, and have been found infected in nature. There is some evidence that old loons may be resistant to infection.

8. *The Life History of* Podocotyle atomon (*Rudolphi*) (*Trematoda: Opecoelidae*). A. V. HUNNINEN AND R. M. CABLE, Oklahoma City University, Purdue University, and the Marine Biological Laboratory.

Experimental studies have demonstrated that the cercaria of *Podocotyle atomon* is a cotylomicrocercous larva and not a trichocercous form as suggested by Palombi (1938). It develops in *Littorina rudis* and is very similar to the cercaria of *Opecoeloides manteri,* both larvae having double-pointed stylets, three pairs of cephalic glands, and an excretory formula of $2[(2+2)+(2+2)]$. Chief differences are in respect to sucker size and the tail; in *P. atomon,* the ventral sucker of the cercaria is larger than the oral sucker and the tail lacks a protrusible glandular core as in the cercaria of *O. manteri.* The marine amphipods, *Gammarus* sp., *Carinogammarus mucronatus,* and *Amphithoë longimana,* serve as intermediate hosts. Of these, the last two are rarely infected in nature but serve readily as experimental hosts. At an age of four weeks, the cyst is 0.3 mm in diameter and the digestive and reproductive systems of the metacercaria are well formed. Old cysts may measure 0.6 mm in diameter and the enclosed worms approach adults in size and

development, becoming sexually mature and producing eggs. The excretory formula is unchanged during post-cercarial development. A number of marine fishes serve as natural definitive hosts. Similarities in fundamental respects demonstrate that *Podocotyle* and *Opecoeloides* are closely related, and that certain differences between their adult stages such as the presence or absence of a cirrus sac, accessory suckers, and junction of the ceca with the excretory vesicle are minor characters probably of no greater than generic value in the Opecoelidae.

9. *Studies on the Life History of* Lecithaster confusus *Odhner (Trematoda: Hemiuridae).* A. V. Hunninen and R. M. Cable, Oklahoma City University, Purdue University, and the Marine Biological Laboratory.

The cercaria of *Lecithaster confusus* is a minute, simplified cystophorous larva developing in the marine snail, *Odostomia* sp. The cyst is discoidal, measuring 0.05 mm in diameter. It contains the cercarial body and inverted delivery tube. Light cover glass pressure causes sudden eversion of the tube and passage of the body through it so rapidly as to be followed only with difficulty. The cercaria is unable to swim, since its only appendage is a simple, delicate, non-motile filament. After escape from the cyst, the cercarial body measures 0.085 mm long. Its structure is poorly defined, even the suckers being indistinct. The excretory vesicle with paired main tubules extending half the length of the body may be observed in favorable specimens. Development of the cercaria from the germ ball has been traced.

Cercariae are eaten by copepods. Twenty per cent of the *Acartia* sp. collected in the vicinity of infected snails were naturally infected. Metacercariae develop rapidly and occur free in the body cavity of the copepod. In 6-day metacercariae, the two main excretory tubules reach the pharyngeal level where their expanded terminations are connected by a cross-commissure which, unlike that of most hemiurids, disappears in the adult stage while another develops near the posterior end of the body. Sticklebacks were used as experimental definitive hosts although many marine fishes may harbor *L. confusus*. The excretory pattern of the adult has been determined.

10. *Studies on the Life History of* Siphodera vinaledwardsii *(Linton) (Trematoda: Cryptogonimidae).* R. M. Cable and A. V. Hunninen, Purdue University, Oklahoma City University and the Marine Biological Laboratory.

The cercaria of *Siphodera vinaledwardsii* is a pleurolophocercous larva developing in rediae in the marine snail, *Bittium alternatum,* from the Woods Hole region. It has 14 cephalic glands with two instead of the usual four bundles of ducts. The tail is inserted ventrally and is coiled when the larva is at rest. The excretory formula is $2[(2+2)+(2+2)]$. The cercaria was found to penetrate and encyst in flounders more readily than in other fishes tried. Metacercariae must be over 9 days of age to establish an infection when fed to toadfish, the natural definitive host. The present study supports the view that *Siphodera* and related trematodes have close affinities with the Heterophyidae and should be included in the superfamily Opisthorchioidea. Because of similarities between the cercaria of *S. vinaledwardsii* and *Cercaria coronanda* Rothschild, which has been referred to the Acanthostomidae, separation of the families Acanthostomidae and Cryptogonimidae may be unwarranted.

11. *Studies on the Life History of a Dicrocoeliid Trematode of the Genus* Lyperosomum. J. Fred Denton, Georgia Southwestern College.

An undescribed trematode belonging to the genus *Lyperosomum* Looss, 1899, was found to be a common parasite in the livers of meadowlarks, *Sternella magna argutula,* and bronzed grackles, *Quiscalus quiscula aeneus,* in the vicinity of Houston, Texas. Incubated eggs from the uteri of mature worms of this species were fed to parasite-free specimens of 7 common species of land snails. The eggs hatched in all 7 snails but development to maturity proceeded only in *Polygyra texasiana* (Moricand) and *Practicollela berlandieriana* (Moricand). Hatching of the eggs

gland to transform into mother sporocysts. Each mother sporocyst produces a single generation of 50 to 70 daughter sporocysts which it liberates into the haemocoele space of the snail's respiratory [illegible] stylet cercariae which migrate out of the daughter sporocysts through the cervical birth canal and actively work their way into the mantle cavity of the host. Here the cercariae collect in masses of 150 to 300, the masses being held together by a slimy material secreted from their large cystogenous glands. These cercarial masses are expelled from the respiratory chamber and are deposited on plants and other objects as the snails crawl along. In the laboratory cultures cercarial masses were first expelled by the snails on the 106th day after infection. Larvae of the chrysomelid beetle *Lastroda* [illegible] of dock (*Rumex* sp.), contained 1 to 6 non-encysted worms at autopsy. No attempts were made to infect the definitive hosts.

12. *The Occurrence of* Dicrocoelium dendriticum *in the United States.* Emmett W. Price and William D. Kinchelow, U. S. Bureau of Animal Industry.

Up to the present time there has been no authentic report of the occurrence of the lancet fluke, *Dicrocoelium dendriticum*, in the United States, although Leidy (1856) noted that this fluke is "Stated to be frequent in the sheep in several of the Western States," and several treatises on parasites have listed the United States as one of the countries in which this species is found. During the past year eight cases of parasitism with the lancet fluke have been encountered in cattle slaughtered at Abattoir No. 1016, Newark, N. J. Four of these were found by the junior author and the remaining cases by Dr. S. R. Roberts. The identity of specimens from all of the cases was checked by the senior author. Through the efforts of Dr. L. V. Hardy, inspector in charge of the establishment, the origin of the parasitized cattle was traced to the state of New York, three of the animals being traced to farms in Cayuga and Portland counties. From information secured from the owners there is no doubt that these were native cases and that the parasite has definitely become established in the state mentioned.

13. Phyllodistomum coatneyi *n. sp., a Trematode from the Urinary Bladder of* Ambystoma maculatum *(Shaw).* F. G. Meserve, Macalester College.

Two out of 19 specimens of *Ambystoma maculatum* were infected with 10 parasites. They were collected at Bass Lake, Wisconsin. *P. coatneyi* is most like *P. americanum*. The vitellaria of *P. americanum* are approximately the same size as the ovary whereas in *P. coatneyi* the vitellaria are only about one-half the size of the ovary. Length 3.3–7.0 mm; width 0.7–1.7 mm; oral sucker 0.301–0.473 mm; acetabulum 0.[illegible]–0.626 mm, to the [illegible] and [illegible]. [illegible] 0.021–0.029 mm. in length by 0.015–0.020 mm. in width. The parasite of *P. americanum*, has eggs which are 0.052 by 0.030 mm. *P. coatneyi* is named in honor of Dr. G. R. Coatney of the U. S. Public Health Service.

14. *The Systematic Position of the Genus* Deropristis *Odhner with Respect to a Proposed Revision of the Trematode Families Acanthocolpidae and Allocreadiidae.* R. M. Cable and A. V. Hunninen, Purdue University, Oklahoma City University, and the Marine Biological Laboratory.

Studies on the life history of *Deropristis inflata* demonstrate that the family Acanthocolpidae is not a natural group of closely related [illegible]. A revision of the family in the light of recent work would exclude the genus *Deropristis* and *Didiscaecus thomasi* Stunkard while the genera *Lepidapedon*, *Plagioporus* and *Pseudolepidapedon* would be included for the first time.

The nearest known relatives of *Deropristis* are undoubtedly members of the Allocreadiidae. The subfamilies Anallocreadiinae, Lepocreadiinae and [illegible] to include *Deropristis* are regarded as a family Lepocreadiidae distinct from the Allocreadiidae, which would be restricted to forms having opisthoporpaeocoel-

cariae developing in bivalves. The Acanthocolpidae and Allocreadiidae, as thus restricted, are regarded as separate but fairly closely related groups, possibly more so than any two subfamilies hitherto allocated to the family Allocreadiidae (sensu lato).

There seems good reason to support Hopkin's (1941) allocation of trematodes having cotylomicrocercous cercariae to a separate family, Opecoelidae, and Manter's (1940) suggestion that the Gyliauchenidae is more closely related to the Lepocreadiinae than to the amphistomes. Superfamily relationships of the Allocreadiidae, Acanthocolpidae, Opecoelidae, Lepocreadiidae, and Gyliauchenidae are not apparent from the fragmentary knowledge of life histories and embryology, particularly of marine forms.

15. *Notes on Embryonating Eggs of* Zygocotyle lunata *and on Their Preparation for Cytological Study.* Gabriel C. Godman and Charles H. Willey, New York University.

Difficulty encountered from mold and bacteria on shells of embryonating eggs of *Zygocotyle lunata* is effectively overcome by keeping living Ostracoda with the eggs. After several washings, 30 to 50 eggs are placed in a covered Petri dish with from 10 to 15 ostracods which may be obtained from aquaria or cultured easily in water containing decaying lettuce. They hold and rotate the eggs with their appendages, effectively scraping off the fungi and leaving them clean and undamaged. The Ostracoda must be replaced and the water changed about every 5 to 7 days, since most of the crustacea die within that period. Ova of *Z. lunata* prepared for sectioning in early stages of development collapse immediately in most common fixatives (Bouins, Helly's, Zenker's, Gibson's). In Flemming's fluid they suffer no change of form, penetration has occurred within 10 minutes and fixation is complete within 30 minutes. Since collapse or rupture occurs in the usual series of alcohols, successful dehydration was accomplished only by the capillary-wick technique of McClung, by which a very gradual instillation of alcohol occurs. They collapse and rupture in pure dioxan, buckle slowly in 50 per cent dioxan, and its gradual addition offers no advantages over alcohol. Clearing must be accomplished slowly with xylol or chloroform by the capillary-wick technique. Gradual infiltration with the rubber-paraffin mixture of Hance is of value in reducing to a minimum the shattering of the shell that occurs in pure paraffin.

16. *Parasites of the Green Turtle,* Chelonia mydas *(L.), with Special Reference to the Rediscovery of Trematodes Described by Looss from this Host Species.* Ross F. Nigrelli, New York Aquarium.

Looss (1899, 1902) reported some 24 species of trematodes from *Chelonia mydas.* The following were recently recovered from the viscera of 50 turtles: (Pronocephalidae) *Cricocephalus albus* (Kuhl and Hasselt, 1822) and *C. megastomus* Looss, 1902 (stomach); *Pronocephalus obliquus* Looss, 1901 and *Glyphicephalus lobatus* Looss, 1901 (intestine); *Pyelosomum cochlear* Looss, 1899 (urinary bladder). A new species of *Charaxicephalus* Looss, 1901 was found in the stomach. No forms of *Pleurogonius* Looss, 1901 were present. *Deuterobaris proteus* (Brandes, 1891), *Octangium sagitta* (Looss, 1899), *Angiodictyum parallelum* (Looss, 1901) and *Polyangium linguatula* (Looss, 1899), all Angiodictyidae, were found in the large intestine. *Microscaphidium* Looss, 1900 is not represented. A specimen of *Schizamphistomoides spinulosum* (Looss, 1901) Stunkard, 1925 (Paramphistomidae) was recovered from the large intestine. Of the intestinal distomes reported by Looss, *Enodiotrema megachondrus* (Looss, 1899) (Plagiorchiidae) was the only one found. Other distomes present in our collection are as follows: (Rhytidodidae) *Rhytidodoides intestinalis* Price, 1939, *R. similis* Price, 1939, and a new species of *Rhytidodoides* Price, all from gall bladders. The family Spirorchidae Stunkard, 1921, is represented in this collection by *Learedius learedi* Price, 1934, and *L. similis* Price, 1934, from the heart and visceral vessels. Large numbers of leeches, *Ozobranchus branchiatus* (Menzies, 1791), were found associated with fibro-epithelial tumors on eyelids. Heavy infections of *L. learedi* and *R. similis* occurred in 65 per

cent of the organs examined. In four cases, a papillomatous disease of the gall bladder (Smith, Coates and Nigrelli, 1941) was found associated with heavy infections of *R. similis*.

17. *Studies on Host-parasite Reactions. V. The Integumentary Type of Strigeid Cyst.* George W. Hunter, III, Wesleyan University, and Wanda Sanborn Hunter, University of California at Los Angeles.

The integumentary type of cyst characteristic of *Crassiphiala bulboglossa* and *Neascus rhinichthysi* is described from the yellow perch, *Perca flavescens*, and the black-nosed dace, *Atratulus atronosus*, respectively. In both cases special connective tissue stains were used. An inner hyaline cyst is elaborated by the parasite while the host responds by producing a connective tissue cyst containing melanin and melanin-bearing cells resembling melanophores. These outer host cysts produced by the fish are, in general, less dense than those noted in the case of parasites penetrating to the deeper layers of the host, as *Uvulifer ambloplitis*.

18. *The Incidence of* Trichomonas foetus *in Wisconsin Cattle.* Banner Bill Morgan, University of Wisconsin.

Examinations were made of the uteri from 560 Wisconsin dairy cows obtained from a local packing plant. Of the 560 uteri examined 416 were pregnant, 110 normal non-pregnant, 31 non-pregnant with pyometra, and 3 pregnant with pyometra. From the total number of uteri examined 8 or 1.4 per cent were positive for trichomonads. Of the 8 cases, the amniotic fluid of an apparently healthy seven-months foetus (approximate age) was teeming with *T. foetus*. From the 31 non-pregnant uteri with pyometra 5 were positive and from the 3 pregnant uteri with pyometra containing macerated foeti 2 were positive. The incidence of *T. foetus* from the 33 uteri with pyometra was 21 per cent.

Amniotic fluid, occasionally allantoic fluid, swabs from the mouth of each foetus, and exudate from uteri with pyometra were inoculated into culture media. The material was incubated at 30° C for 18 hours and examined for trichomonads. After the first examination the cultures were incubated at 37° C for 18 hours and examined again. The culture material was the all-autoclaved medium of Schneider (unpublished thesis). Occasionally egg slants layered with saline, Ringer's, or saline and serum were used.

Four cases of trichomoniasis have been positively diagnosed out of 28 herds representing a total number of approximately 500 dairy cows for an incidence of 0.8 per cent. This is a preliminary report, but the above figures indicate that trichomoniasis, at least in Wisconsin, is an important problem in the dairy cattle industry.

19. *The Effects of Sulfaguanidine on Experimental Bovine Coccidiosis.* Donald C. Boughton, U. S. Regional Animal Disease Research Laboratory, Auburn, Alabama.

In one experiment 9 calves were inoculated simultaneously with approximately 50 million sporulated oöcysts of mixed types from one large suspension. Four of the 9 received no drug. All of these developed clinical coccidiosis, *Eimeria bovis* being the dominant species. One was sacrificed when moribund 15 days after inoculation. The remaining three died on the 20th, 21st, and 27th days, respectively. Five calves were given at least 21 consecutive daily doses of sulfaguanidine at the rate of 0.1 gm per 2.2 pounds of body weight beginning 2 days after inoculation. The 5 treated calves survived, did not develop clinical coccidiosis, and discharged very few *E. bovis* oöcysts during the month following inoculation. In a second experiment 12 calves were given a similar inoculation of infective oöcysts from a second suspension. Three calves received no drug. Sulfaguanidine was given to the remaining 9 calves at the rate of 5.0 gms per day for 8 consecutive days as follows; three calves, at the time of inoculation; 3 calves, mid-way in the 3-week incubation period; and 3 calves, toward the end of the incubation period. All calves receiving the early and mid-way treatment and 2 of the 3 untreated calves developed

fatal coccidial infections, *E. bovis* being the dominant species. The surviving untreated calf developed *E. bovis* infection. The 3 calves treated late in the incubation period survived; none discharged large numbers of *E. bovis* oöcysts during the month following inoculation.

20. *Immunization against Coccidiosis by the Use of X-ray Attenuated Oöcysts.* S. H. Waxler and C. A. Herrick, University of Wisconsin.

Chickens that are infected with x-ray attenuated oöcysts acquire a certain amount of resistance to a second heavy infection. This resistance, when measured by the hemoglobin level after infection, is almost as great as that afforded the survivors that had been infected originally with untreated oöcysts. The attenuated oöcysts not only gave protection against subsequent reinfection but were safe at the initial infection. It was, however, necessary to standardize the oöcyst dose in roentgen units for the different age groups of chickens. The younger birds required oöcysts attenuated for a slightly longer time than did the older ones. By varying the amount of radiation, it is possible to control fairly accurately the severity of the disease. The longer the oöcysts were subjected to the rays, the less severe was the disease. The use of x-rays as the attenuating agent appears to be quite satisfactory, in that results, as indicated by the hemoglobin change, can be duplicated by using the same quantity of radiation measured in roentgen units.

21. *Hatching Ascaris Eggs in Vitro.* George L. Graham, Rockefeller Institute for Medical Research, Princeton, N. J.

It was shown by Graham (1937) that rats were inferior to guinea pigs for demonstrating lung hemorrhage due to migration of swine ascaris larvae following feeding of infective eggs. Experiments conducted to ascertain conditions under which hatching occurred in vivo, established that eggs introduced directly into the intestine of guinea pigs were effective in producing heavy lung damage, but not in rats. This demonstrated that hatching occurred normally in the guinea pig intestine at least, without the necessity of stomach passage.

In hatching experiments conducted in vitro, infective eggs were incubated at 38° C. Tubes containing increasing quantities of guinea pig bile showed a correlated increase in hatching when a small piece of guinea pig pancreas was present. Tubes containing bile alone, or pancreas alone, showed no evidence of hatching. The increased hatching with increasing amounts of bile in the presence of pancreatic enzymes is, interestingly enough, correlated with the absence of a gall bladder in the rat and its presence in the guinea pig.

22. *Some Clinical Aspects of Experimental Esophagostomiasis in Cattle.* John S. Andrews, U. S. Bureau of Animal Industry.

At the Puerto Rico Agricultural Experiment Station it was found that administration of 20,000 to 260,500 infective larvae of *Oesophagostomum radiatum* by mouth to healthy calves weighing from 70 to 280 pounds produced transient rises in body temperature to 104° F or above, at approximately 4 and 10 days after infection, which appeared to be correlated with the presence of the newly arrived third stage larvae in the intestinal wall, and with the exit of the fourth stage larvae from the mucosa, respectively. Severe diarrhea, accompanied by anorexia and tenesmus, began 4 to 23 days after infection and continued for periods up to 186 days. A transient polymorphonuclear leucocytosis associated with the repair of intestinal tissue damaged or destroyed by the larvae occurred 2 to 4 weeks after completion of infection. A reduction of 50 per cent in the number of erythrocytes developed about 5 weeks after infection, the red blood cell count returning to normal with the disappearance of clinical symptoms. Absence of blood in the feces indicated that the anemia may have been due to the action of some toxin on the hematopoietic system. Difficulty was experienced in the early diagnosis of the disease because of the absence of worm eggs from the feces for a period of from 3 to 5 weeks after the onset of the diarrhea. The number of adult *O. radiatum* recovered post mortem did

not appear to bear any relation to the severity of the disease. Death occurred in one calf following infection with 82,000 larvae.

23. *The Biology and Ecology of the Snail,* Stagnicola bulimoides techella *(Hald.), Intermediate Host of* Fasciola hepatica *Linn., in South Texas.* O. Wilford Olsen, U. S. Bureau of Animal Industry.

The snail *Stagnicola bulimoides techella* (Hald.) is the most important intermediate host of the liver fluke in the coastal section of Texas. The composition of the snail population varies according to the season and its weather. Generally speaking, however, juvenile snails predominate in the fall, juveniles and adults being about equal during the winter and the adults exceeding in number during the spring. In one habitat, 92 per cent of the snails found dead on the surface after the pool had dried were adults while 98.6 per cent of the surviving population which reappeared with the advent of standing water after 169 days of drought were small juveniles. In habitats under conditions of more evenly distributed rainfall, adult snails aestivate commonly, even carrying infections of *Fasciola hepatica* through the period of dormancy. During rainy weather when pools contain water throughout the summer, reproduction is continuous. Snails occur in greatest numbers during the winter. Associated with a high reproductive potential is a short life cycle which may be completed in 21 days under optimum conditions. During a total of 334 egg-laying days extending through July, August and September, four laboratory snails deposited 17,432 ova. The mean number of ova per snail per day was 52.9, the daily mean number of egg masses 2.8 with a mean number of 18.5 ova per mass. Natural infection of snails with *Fasciola hepatica* taken from pastures during the current year when rainfall has been high and at frequent intervals, where cattle grazed constantly, was 0.51 per cent.

24. *Losses of* Haemonchus *Larvae Early after Their Administration to Susceptible Sheep.* Norman R. Stoll, Rockefeller Institute for Medical Research, and J. H. Tetley, Massey Agricultural College.

*Haemonchus contortus* in susceptible sheep represents a worm-host system characterized by a high degree of infectivity of the nematode and its marked pathogenicity for the host. Effective parasitization is favored because infective larvae, being swallowed, are brought in due course to the abomasum. Worms which pass beyond this 4th stomach are irretrievably lost (although such larvae, if still alive and promptly rescued from the fecal pellets, can be shown normally infective).

The present tests employed huge single doses of larvae. None was recovered the first six hours, but fecal collections the next two hours were already positive for larvae in some animals. Once demonstrated, larvae were found continually discharged during the first three days, the longest period studied. In one instance an animal sacrificed 72 hours after oral infection of 941,000 larvae showed respectively 18, 7, and 1 per cent of these in the three 24-hour periods preceding post mortem demonstration of 261,000 (28 per cent) established in the abomasum. The limiting factor did not appear to be their number in the abomasum. In two cases where over 319,000 were present there at the end of one day, about 1 per cent of inoculated larvae were demonstrable in feces before death; original dose was given orally in one case, injected directly into the rumen through the body wall in the other. While infection losses are not unlooked for, with *Haemonchus* they represent organisms which, after successfully reaching the abomasum, fail to remain in the one parasitic habitat where they can survive. Lost larvae are characteristically exsheathed.

25. *The Effect of Milk Diet on the Development of* Haemonchus contortus *in Calves.* Dale A. Porter, U. S. Regional Animal Disease Research Laboratory, Auburn, Alabama.

Three pairs of calves, kept under parasite-free conditions since birth, were used in these experiments. One calf of each pair was maintained on a control diet of

cow's milk, alfalfa hay and grain. The other calf of each pair was fed nothing but milk from the time of birth until the termination of the experiments, approximately a month after feeding infective larvae of *H. contortus*. The calves of the first pair were fed 98,000 larvae each; those of the second, 26,000; and those of the third, 10,500 when 4, 3, and 2 months old, respectively. Although the calves on the milk diet failed to develop properly in comparison with their controls they did not become anemic or more susceptible to parasitism as was anticipated from the results of previous work with milk diet and parasitism (Porter, 1935; Foster, 1936). At necropsy the calves in each pair that were fed only milk harbored 282, 346, and 0 worms, whereas their respective controls on a normal diet harbored 2,888, 8,202 and 887 worms. The worms from the milk-fed calves were also smaller than those from the calves on the regular diet. Failure of these blood-feeding parasites to develop in the milk-fed calves is possibly due to unfavorable environmental factors in the abomasum.

26. *Studies on Bovine Gastro-intestinal Parasites: VII. The Effects of a Low Plane of Nutrition (Cottonseed Hulls) on Immunity to the Stomach Worm* (Haemonchus contortus). Roy L. Mayhew, Louisiana State University.

The immunity to the stomach worm, *Haemonchus contortus*, has not been completely broken down and but little reduced by the feeding of cottonseed hulls to three calves. Each animal was demonstrated to be resistant by reinoculation, repeated egg counts, and post mortem examination.

27. *Further Data on the Blood Picture in Stomach Worm* (Haemonchus contortus) *Infections*. Elaine T. Delaune and Roy L. Mayhew, Louisiana State University.

In addition to the description of the bood picture of three calves recorded previously (1940, J. Parasitol. 26 Suppl: 17) data on three more animals are here presented. The erythrocytes decreased approximately 2 to 3½ million below the 9,500,000–10,300,000 normals between the 5th and 8th days after inoculation. A further decrease of about 2 million occurs within 23–28 days after inoculation. The hemoglobin, likewise, decreases in a similar proportion on approximately the same days. The total leucocyte counts increase from the pre-inoculation normal (9,600–11,000) to 15,800 to 27,900 five to seven days after inoculation. A rapid decrease follows within the next 25 days to minimum counts of 1,700 to 7,000 in different animals. A much greater range of variation persisted during the entire period of observation in the hemoglobin determinations, total erythrocytes and leucocyte counts in all animals after inoculation than during the pre-inoculation period. There was an increase in the monocyte and a decrease in the lymphocyte percentages. But very slightly, 1 to 2 per cent, higher eosinophile percentages were obtained after inoculation than before.

28. *Notes on the Musculature of the Male Genitalia of* Haemonchus contortus. W. L. Threlkeld and M. E. Henderson, Virginia Agricultural Experiment Station.

A study of longitudinal and cross sections through the posterior region of the male nematode, *H. contortus*, shows that the gubernaculum is supported and slightly activated by longitudinal and transverse muscles and that the location of these muscles implies that slight movement is possible in three directions. Other muscles are described and their functions are explained on the basis of their origins, insertions, and locations: (a) Muscles 1 and 3, each named *retractor spicularis lateralis*, function to retract the spicule. (b) Muscle 2, *retractor spicularis centralis*, functions to retract the spicule. (c) Muscle 4, *protractor spicularis*, functions to extrude the spicule and assist in contraction of the bursa. (d) Muscle 5, *dilator cloacae*, functions to dilate the cloaca. (e) Muscle 6, *bursa expansa*, functions to expand the bursa.

Spermatazoa contained in gelatinous capsules are found in the grooves formed

by the longitudinal spicular ridges. Two pairs of glandular-like bodies are shown proximal to the intestine.

29. *Sulfaguanidine Feeding as a Control Measure for Cecal Coccidiosis of Chickens.* MARION M. FARR AND REX W. ALLEN, U. S. Bureau of Animal Industry.

Tests involving 100 chicks used as principals, and 100 inoculated and 25 uninoculated control chicks, were conducted to determine the value of sulfaguanidine as a prophylactic for *Eimeria tenella* infections. The birds were 12 to 16-day old Rhode Island Reds. One-half of the principals received a mash containing 1 per cent sulfaguanidine, and the other half received a mash containing 2 per cent of the drug for a period beginning 4 days before and ending 9 days after inoculation. Neither group exhibited symptoms of coccidiosis. A few coccidial stages were found in the group receiving the 1 per cent mash, but none was found in the group receiving the 2 per cent mash. All inoculated controls exhibited typical symptoms of cecal coccidiosis and 33 per cent died. The mean gains in weight of the various groups were as follows: One per cent sulfaguanidine group, 99.8 gm; 2 per cent group, 95.6 gm; inoculated controls, 76.8 gm; uninoculated controls, 118.2 gm. The results indicate the efficacy of the drug as a preventive.

In order to test the possible curative value of sulfaguanidine 25 chicks were given 3 per cent medicated mash and 25 were given 5 per cent medicated mash at the first sign of blood in the droppings. This treatment was continued for 6 days. Although the oöcyst production was sharply reduced by the treatments named, there was no evidence that the drug had a significant curative effect.

30. *Effect of a Single Dose of Phenothiazine upon Egg Production and Viability of the Eggs of Swine Lungworms.* L. A. SPINDLER AND KENNETH C. KATES, U. S. Bureau of Animal Industry.

A pig passing approximately 2,247,000 lungworm eggs per day (experimentally infected) was given 20 gms of phenothiazine mixed with feed. Each day thereafter, counts were made of the number of lungworm eggs in the feces. Earthworm-feeding tests of the viability of the eggs in representative 50-gram samples of feces were made prior to administration of the drug and each day thereafter. Prior to administration of phenothiazine the average infection acquired by individual earthworms varied from 400 to 500 lungworm larvae. Three days after treatment the number of lungworm eggs passed was approximately 1 million but in earthworm-feeding tests these annelids acquired an average infection of less than 1 larva each. Seven days after treatment the feces contained approximately 500,000 lungworm eggs and earthworms acquired average infections of more than 200 larvae each. By the eleventh day after treatment the number of lungworm eggs in the feces and the infections acquired by earthworms in the feeding tests had returned to near pretreatment levels. Feces collected 3 days after administration of phenothiazine were exposed to prevailing weather conditions for 1 month on soil outdoors. In subsequent feeding tests each earthworm acquired an average infection of slightly less than 200 larvae. This shows that the phenothiazine present in the feces following treatment did not destroy the viability of the parasite eggs but apparently prevented the earthworms from ingesting them. The data also show that administration of phenothiazine is ineffective for the removal of lungworms from swine.

31. *Limited Tests of Phenothiazine as an Anthelmintic in Goats.* PAUL D. HARWOOD AND JAMES E. GUTHRIE, Dr. Hess and Clark Laboratories, Ashland, Ohio.

Goat 22 received 25 grams of phenothiazine November 13, 1940. Fecal examination revealed two *Chabertia,* 61 *Oesophagostomum venulosum,* and 4 *O. columbianum* removed. Necrospy 4 days after treatment revealed 9 *O. venulosum* and 3 *Chabertia.* Before treatment *Haemonchus* eggs were found in the feces, but no *Haemonchus* were recovered post-treatment. Goat 20 received 25 gms of phenothiazine February 11, 1941. Fecal examination revealed two *Oesophagostomum*

*columbianum* and one *Bunostomum* removed. By sampling the feces 30 *Trichostrongylus* (S.D. ± 3.75) were discovered. Necropsy on February 17 revealed 25 *Trichostrongylus* and 25 *Cooperia*. Goats 24 and 21 received 250 gms of phenothiazine each, and goat 23 received 100 gms November 13, 1940. Daily temperatures and haematocrit readings following treatment did not vary significantly. Milk yields of goats 24 and 21 dropped on November 16 to approximately 60 per cent of the pretreatment level, but were above pretreatment level November 18. Treatment January 21, of goat 21, with 1,000 gms of phenothiazine, produced similar effects. Goat 24 received 2,000 gms of phenothiazine April 2; the milk volume diminished by 94 per cent on April 5, but recovered to 90 per cent of the pretreatment level by April 18. Goat 24 was sluggish and appeared to suffer abdominal pains April 3; the symptoms diminished April 4. Twin kids born to goat 19, March 27, developed evenly and normally, although goat 19 received phenothiazine doses, each of 25 gms, March 18, April 15 and 25; and of 50 gms, April 30.

*32. Skin and Precipitin Tests for the Diagnosis of Trichina Infections in Grain-fed and in Garbage-fed Hogs.* L. A. Spindler and John L. Avery, U. S. Bureau of Animal Industry.

In a large series of skin tests and a smaller series of precipitin tests made on hogs prior to slaughter in abattoirs, the tests often gave positive reactions in trichina-free hogs and sometimes failed to detect infections in hogs later shown to be trichinous. To test the effect of garbage feeding on the occurrence of non-specific skin and precipitin tests, skin and precipitin tests were made on 108 hogs experimentally fed garbage for 7 months and on 78 grain-fed hogs of comparable ages, sizes and breeds. Nine of the garbage-fed and 37 of the grain-fed hogs were experimentally infected with trichinae from 12 to 18 months prior to testing. The animals were kept outdoors under hog-lot conditions.

Of the infected, grain-fed hogs, positive reactions to precipitin tests were obtained in 81 per cent; skin tests were positive in 78 per cent; both tests were negative in 8 per cent. In the infected garbage-fed hogs, precipitin and skin tests were each positive in only 66 per cent; both tests were entirely negative in 22 per cent. In the uninfected grain-fed group, positive precipitin reactions were obtained in 23 per cent and positive skin tests in 13 per cent; both tests were positive in 7 per cent. In the uninfected garbage-fed hogs, positive precipitin tests occurred in 37 per cent and positive skin tests in 44 per cent; both tests were positive in 20 per cent. These data show that skin and precipitin tests for the diagnosis of trichina infections are less reliable in garbage-fed hogs than in hogs fed entirely on grain.

*33. Reactions in Garbage-fed and in Grain-fed Hogs to Intracutaneous Injections of Various Diluents.* John L. Avery, U. S. Bureau of Animal Industry.

In intracutaneous tests for the detection of trichina infections in swine, reactions to control injections of diluents occurred in as many as 12 per cent of various lots of hogs tested. Some of the diluents used are commonly employed in intracutaneous tests on human beings. To ascertain the effect of diluents alone when injected into swine, intracutaneous tests with several sterile solutions were made on 62 hogs fed garbage experimentally and on a comparable series of 50 grain-fed hogs. The reactions produced were in the form of either a solid pink, red, or purple color in the skin area injected, or an anemic wheal surrounded by a pink, red, or purple zone. Reactions to Coca's solution occurred in 39 per cent of the garbage-fed and 26 per cent of the grain-fed hogs. Coca's solution without phenol produced reactions in 51 per cent of the hogs fed garbage and in 43 per cent of those fed grain. Reactions to physiologic saline containing 0.5 per cent phenol occurred in 36 and 29 per cent of the two groups, respectively. A buffered saline solution produced reactions in 45 per cent of the garbage-fed and 8 per cent of the grain-fed hogs tested. These data show that reactions to intracutaneous injections of diluent occurred more frequently in the garbage-fed hogs than in those fed grain, and indicate that the diluents used contributed to the nonspecific reactions in swine.

*34. Precipitate Formation around Trichina Larvae in Sera from Trichina-infected, and Trichina-free Hogs.* L. A. Spindler, John L. Avery, and Harry E. Zimmerman, Jr., U. S. Bureau of Animal Industry.

Recently several investigators have reported the formation of precipitates around the mouth of decapsulated larvae of *Trichinella spiralis*, when the larvae were incubated in sera of trichina-infected rats, rabbits, guinea pigs, and humans. In 1933 the senior author incubated decapsulated trichina larvae in sera of 3 trichinous and 3 non-trichinous hogs. Precipitates formed around a small proportion of the larvae in sera from 2 of the 3 infected swine and also around some larvae in the sera of each of the uninfected hogs. Recent investigations by the present authors involved sera from 14 experimentally infected and 11 uninfected swine, the technique used being that described by Olivier-Gonzales (1940), except that from 5 to 200 larvae were used per serum preparation. No precipitates formed in the case of larvae incubated in sera from 4 (29 per cent) of the infected hogs irrespective of the number of larvae used. In the remainder, from 1 to 71 per cent of the larvae involved (average 17 per cent) showed the formation of precipitates. Typical precipitates were observed in 1 to 73 per cent (average 7 per cent) of the larvae incubated in sera from 49 (88 per cent) of the uninfected hogs; sera from the remaining hogs failed to cause the formation of precipitates. Precipitates in sera from uninfected hogs appeared on microscopic examination to be identical with those in sera from infected hogs. These observations indicate that this test cannot be relied upon to detect with certainty trichina infections in swine.

*35. Experimental Infection of Pigs with the Swine Thorn-headed Worm,* Macracanthorhynchus hirudinaceus. Kenneth C. Kates, U. S. Bureau of Animal Industry.

Approximately 20 infective juvenile forms (acanthellas) of the swine thorn-headed worm were fed in one dose to each of 4 pigs (numbers 710, 706, 707, and 693), and a total of several hundred (estimated) acanthellas were fed to a fifth pig (number 777) in 4 successive doses at 4-week intervals. The infective stages in question were obtained from grubs, pupae and adults of the green June beetle, *Cotinis nitida* that had been infected 2 to 3 months previously while in the final instar stage. The prepatent period of the parasite was about 2½ months and the patent period 6 to 9½ months, with the peak of egg production occurring 5 to 7 months after infection. At the peak of egg production each female worm produced approximately 400,000 eggs per day. The numbers of mature parasites recovered at necropsy from the pigs were respectively 2 females, 1 male; 1 female, 4 males; 6 females, 3 males; 1 female; and 9 females, 7 males. With the exception of pig 777 more nodules than worms were found in the jejunum of the host at necropsy, indicating that the parasites did not remain attached at one spot. This conclusion is based on the fact that except in pig 777 no acanthocephalids were passed in the feces during the course of the experiment. In the case of pig 777, all the females and one male were spontaneously eliminated by the host at various intervals from 6 months to 2 weeks prior to necropsy, 13 months after infection. At that time fewer nodules than worms were found, thus indicating that the nodules disappeared following loss of the worms.

*36. The Duration of Infectivity of Nematode Parasites of Cattle on Florida Pasture with Observations on Resistance of Calves to Natural Re-infection with* Haemonchus contortus. Doyle A. Porter, U. S. Regional Animal Disease Research Laboratory, Auburn, Alabama, Leonard E. Swanson and Terrence J. Drake, University of Florida.

On April 1, 1941, six parasite-free yearlings were turned on a carpet grass pasture at Gainesville, Florida. This pasture was last grazed by parasitized cattle the previous fall (November 10, 1940). These yearlings were killed and examined for parasites, two each on the 35th, 91st, and 144th day after the beginning of the test. *Haemonchus contortus*, *H. similis*, *Cooperia pectinata*, *Trichostrongylus*

*axei*, *Cooperia punctata*, *C. pectinata*, *Oesophagostomum radiatum* and *Trichuris* sp. were recovered from these yearlings collectively but *Bunostomum phlebotomum* and *Dictyocaulus viviparus*, also present in cattle on the pasture the previous November, were not found. The free-living stages of the latter species were apparently unable to remain infective for the period of nearly five months during which the pasture had been vacant. (Temperature, 24° to 85° F., rainfall 18.05 inches.) Judging from the number of worms recovered, *H. contortus* and *O. radiatum* were by far the most successful survivors. One each of the first two pairs of yearlings had been previously infected experimentally with *H. contortus* at Auburn, Alabama, but had eliminated these worms some time before going on pasture. That these animals were resistant to natural reinfection with this parasite was indicated by the failure of *H. contortus* to develop in them, whereas the other yearlings acquired large numbers of this species.

*37. The Occurrence of Mites in Pinnipeds, Including a New Species from the California Sea-Lion.* Zalophus californianus. Willis H. Doetschman, University of Southern California and The Biological Research Institute, Zoological Gardens of San Diego.

A number of sea mammals, belonging to the suborder Pinnipedia, were examined at autopsy at the San Diego Zoo to determine the prevalence of mites belonging to the genus *Halarachne* Allman, 1847. Permanent mounts were made by a modified technique of Ewing's combination clearing-mounting media. The main changes in Ewing's technique were the addition of basic fuchsin stain and the use of less chloral hydrate and more glycerol. A total of 74 animals were studied including 55 California sea-lions, *Zalophus californianus*; 6 Stellar's sea-lions, *Eumetopias jubata*; 11 California harbor seals, *Phoca richardii*; and 2 elephant seals, *Mirounga angustirostris*. Infection of the lungs was found in 60.8 per cent and of the nasal passages in 21.8 per cent of these animals; a total of 70 per cent were infected. *H. zalophi* Oudemans, was found in the nasal passages of Stellar's sea-lion (a new host record) and the California sea-lion. *H. mirungae* Ferris, was taken from the nasal passages of the California harbor seal (a new host record) as well as the elephant seal. Male specimens of this species, previously unreported, were also collected.

A new species was recovered from the bronchial passages of the California sea-lion. This species is smaller than any previously described. The average size of the females is 920 μ; males, 660 μ. The dorsal plate is oval and contains 6 pairs of setae in both sexes. Morphology of the mouth parts of this species is distinctly different from species previously reported. A more detailed description of this mite and a discussion of the validity of the existing species of *Halarachne* will appear in another paper.

38. *Observations on the Duration of an Infection of* Hymenolepis nana *in Man.* William Hugh Headlee, Purdue University.

In 1933 a male individual 26 years of age was found to be infected with *Hymenolepis nana*. From January, 1933, to August, 1940, thirty-four stools from this person were examined and each was found to be positive for that parasite. The infection was light when discovered, and continued to be light until June, 1938. At that time the infection became markedly heavier, and then gradually decreased in intensity until it reached its former level after six months. It then became necessary on occasion to use concentrate methods in order to detect the infection. Dilution egg-counts were made on eight stools, the number of ova detected ranging from 200 to 7,800 per gram B.F. At the time the tapeworm infection increased markedly, a heavy infection of *Chilomastix mesnili* was found, and it persisted for a month. The increase in the intensity of the tapeworm infection at that time may have resulted from a disturbed balance due to the presence of *C. mesnili* in large numbers. Other parasites frequently found were the amoeba, *Endolimax nana*, and the yeast, *Blastocystis hominis*. The infection of *H. nana* was terminated in August, 1940, by treatment with hexylresorcinol. Four stools examined since that time, over a

period of more than a year, have been negative. Reinfection was guarded against by the practice of rigid sanitary habits. It is considered that direct reinfection did not likely occur and that the life-span of this cestode is considerably greater than formerly believed, or that internal autoinfection may have occurred.

39. *The Effect of Host Age on the Number of* Trichinella spiralis *Recovered from Rats during the Early Period of Infection.* L. O. Nolf and Herman Zaiman, State University of Iowa.

Sixty-eight rats belonging to three age groups were used in five experiments to study the effect of host age on the intestinal phase of trichinosis in rats. Group A consisted of 28 rats ranging in age from 3 to 12 months. Group B consisted of 22 five-week-old rats. Group C consisted of 18 unweaned rats between 8 and 15 days old. Each rat received 2,000 *T. spiralis* larvae per os. With only two exceptions, recoveries were made between 36 and 86 hours after infection. The two exceptions were a 15-day-old rat and a 12-month-old rat which were autopsied eight and one-half days after infection. For statistical analysis, the data from all rats in the same group were considered together. The lowest average number of worms, 1,042 (S.D. = 246), was recovered from the unweaned rats, Group C. The next highest average number, 1,554 (S.D. = 260), was recovered from Group A, the 3 to 12-month-old rats. The highest average recovery, 1,777 (S.D. = 175), was made from the five-week-old rats, Group B.

The difference between the averages of Groups A and C is 512. It is 6.6 times the standard error of the difference of the means. The difference between the averages of Groups B and A is 223. It is 3.6 times the standard error of the difference of the means. The difference between the averages of Groups B and C is 735. It is 10.4 times the standard error of the difference of the means.

40. *The Effects of Immune Serum upon the Larvae of* Trichinella spiralis *in Vitro.* Edward P. Offutt, Jr., University of Rochester.

In repeated experiments, no significant effect has been demonstrated on the infectivity for rats of *Trichinella spiralis* larvae following their exposure to immune rabbit serum for periods as long as from three to five days. Such larvae showed approximately the same infectivity as larvae exposed to normal rabbit serum under similar conditions. Infectivity was measured by counting the number of larvae that were able to develop to the adult stage. In one experiment, the productivity of the resultant worms was determined by counting the number of larvae recovered upon digestion of the rats a month later. No significant effect was observed.

All immune sera used in the present experiments possessed preciptin titers of at least 1 : 10,000. Precipitates were observed to form at the anterior ends and along the bodies of larvae incubated in immune serum at 37° C, but the death rate of these larvae was not markedly different from that of larvae incubated in normal serum. A few larvae remained alive for as long as three weeks in both immune and normal sera.

41. *Attempted Passive Transfer to Rats and Mice of Immunity to* Trichinella spiralis. O. R. McCoy and Franklyn F. Bond, University of Rochester.

Various attempts to transfer immunity to rats and mice by the intraperitoneal injection of serum from rats and rabbits which had survived repeated feedings with larvae of *Trichinella spiralis* have failed to demonstrate the passive transfer of any significant degree of increased resistance. In one typical experiment, serum pooled from 48 highly resistant rats was injected into 15 young adult rats in amounts totaling 6 cc per 100 gm of body weight. Seven rats killed within 8 days after a test dose of 1,500 *Trichinella* larvae contained approximately the same number of worms in the intestine as was found in control animals. Also, the average number of larvae recovered by digestion from the muscles of the remaining 8 rats, which were killed after 6 weeks, was not significantly different from the number recovered from 8 control animals.

Four experiments were performed in which groups of 10 mice were injected with immune rabbit sera having precipitin titers of at least 1 : 12,500. Each mouse received approximately 10 cc of serum per 100 gm of body weight. When fed a test dose of 300 *Trichinella* larvae, the mice injected with immune serum showed, on the average, about the same amount of intestinal and muscle infection as did comparable groups of control mice which either had received normal rabbit serum or were untreated. These findings fail to confirm the experiments of Culbertson and Kaplan (1938, Parasitology **30**: 156–166) which reported increased resistance in mice injected with immune rabbit serum.

42. *The Protective Action of Normal Sheep Serum against Infections of* Trypanosoma duttoni *in the Mouse.* WILLIAM H. TALIAFERRO AND YELENA PAVLINOVA OLSEN, University of Chicago.

The protective property of sheep serum against *T. duttoni* in mice described by Thiroux has been amply confirmed. Complete or partial protection may result from doses as low as 0.1 cc sheep serum per 20 gm mouse. Zone phenomena are frequent in titrating serums with graded doses. The anti-*duttoni* property is of variable occurrence in sheep and varies in titer in the same animal at different times. No satisfactory explanation for most of this variability has been found. Evidence from sheep of different ages and serial tests during two years on one mother and her lamb indicate that the protective property is present in the mother, but absent in the newborn lamb and does not appear in the lamb's blood until after a year. The titer of the protective property is only diminished just before death after severe liver injury due to (a) poisoning with carbon tetrachloride, (b) pregnancy disease and (c) partial occlusion of the vena cava.

43. *The Trypanocidal Action of Sheep Serum on* Trypanosoma duttoni. WILLIAM H. TALIAFERRO AND LUCY GRAVES TALIAFERRO, University of Chicago.

In the mouse, the protective property of sheep serum against infection with *T. duttoni* is slightly decreased after splenectomy and markedly decreased when splenectomy is combined with blockade by repeated doses of India ink or sheep serum (exhaustion experiments). In vitro, sheep serum is trypanocidal to *T. duttoni.* Although the results are not entirely consistent, they indicate that the property behaves like an antibody since it is absorbed by the parasites and is inactivated by heating at 56° C for 20 minutes and reactivated by the addition of fresh guinea pig serum.

44. *Quantitative Relationships in Immunity to Hookworm.* G. F. OTTO, Johns Hopkins University.

Single doses of 1,200 to 1,400 infective larvae of the dog hookworm, *Ancylostoma caninum,* induced immunity in dogs sufficiently powerful to protect them from subsequent infections of 50,000 larvae. Single doses of 300 larvae, however, were not sufficient to protect the animals from 50,000 larvae. It seems likely, however, that some degree of immunity was induced by 300 larvae since the sera of such animals, in some cases, formed precipitates with living larvae in vitro. A similar precipitin reaction was observed with *Necator americanus* larvae in sera of infected humans. Preliminary studies, however, indicate that the reaction is not qualitatively specific since some canine immune sera reacted with *N. americanus* larvae and some sera of infected humans reacted with *A. caninum* larvae.

45. *Natural Resistance to Helminthic Infections.* JAMES E. ACKERT, Kansas State College.

Presidential address.

46. *A Case of Intestinal Myiasis.* MARCUS W. LYON, South Bend Clinic, AND JOHN D. MIZELLE, University of Notre Dame.

A twenty-three-year-old woman of South Bend, Indiana, reported to her physician that she had passed "worms" in her stools for the interval of approximately one

month. A specimen examined in August, 1941, by the senior author revealed that the organisms in question were fly larvae (*Lucilia sericata*). The patient reported no intestinal symptoms; the stool examined was normal in shape and color; and the larvae present were more toward the outside of the fecal mass than otherwise. Three years prior to this diagnosis the patient complained of a burning sensation during urination but it is thought that this probably has no connection with the *Lucilia sericata* infection. However, Chandler has reported (1941, J. Parasitol. **27**: 465), a case of urinary myiasis with symptoms of a similar nature. It is not known how the maggots gained access to the digestive tract of the patient. Her house was unscreened and she complained of the large number of flies therein.

The authors are grateful to Dr. W. B. Herms for specific identification of the larvae.

47. Hexamita *in the Blood of a Mouse.* JUSTIN ANDREWS AND MADGE REYNOLDS, Georgia Department of Public Health.

The specimen shown is a thin blood film made from the lung-blood of an autopsied mouse, one of three inoculated intraperitoneally with human blood from a suspected case of relapsing fever. Two remained healthy and never gave evidence of blood parasitism. The twelfth day after inoculation, the third mouse showed progressive signs of sickness—sluggishness, rough coat, loss of weight. Films of tail blood diluted with sterile physiological saline were examined for spirochetes at daily intervals commencing the fourth day after inoculation. On the 12th, 13th, 14th and 15th days, unidentified organisms called flagellates, because of their characteristic, jerky movements, were seen in both bright- and dark-field preparations. These were present in small numbers and could not be found in Giemsa-stained thin films. On the 16th day after inoculation, the mouse died and was autopsied six hours thereafter. Thin smears were prepared from the lung, liver, spleen and kidney. On each of these, stained with Giemsa's stain, organisms which appear to belong to the genus *Hexamita* (*H. muris?*) were found. They were most plentiful in the lung-blood. There was no evidence of contamination with intestinal contents in any of the blood smears. No attempt was made to transfer these organisms to other mice.

Thin blood films were examined from 116 other members of the mouse colony but no *Hexamita* was found. Twelve of these were autopsied and smears of upper and large intestinal contents in physiological saline were examined. An abundant colonization of *Hexamita* throughout the intestine was found in a single case. According to Wenyon (1926), *Hexamita* has been found in the blood of cold-blooded vertebrates (frogs and tortoises). This appears to be the first record of its presence in the blood of a mammal.

48. *Two Unusual Trematodes.* H. W. MANTER, University of Nebraska.

Demonstration of black trematodes (*Campula* species) from the liver of a porpoise (*Tursiops gillii*) from the Pacific. Although Poirier (1886) described *Campula rochebruni* as "couleur noirâtre," he attributed this color "au vitèllogene très développé sur toute la longueur du corps." In my specimens a very persistent black pigment is scattered in granules throughout the parenchyma. Living specimens were very black.

A lepocreadid trematode from a marine fish (*Epinephelus morio*) from Tortugas, Florida, has the genital pore median and directly *posterior* to the acetabulum. It represents a genus near *Anallocreadium.*

49. *Two Species of* Porrocaecum (*Nematoda*) *from the Robin.* J. DAN WEBSTER, Rice Institute.

More than 30 individual worms of this genus were taken from 7 out of 19 American robins (*Turdus migratorius*) examined at Ithaca, New York. Five specimens are *Porrocaecum ensicaudatum,* which has previously been reported in North America only from the mockingbird (*Mimus polyglottus*); the rest belong to a new species of *Porrocaecum* which is most nearly related to *P. cheni* of the Chinese blackbird (*Turdus mandarinus*).

50. *The Genus* Gnathostoma *in North America.* Asa C. Chandler, Rice Institute.

Leidy, 1858, reported a gnathostome from the stomach of a mink; this species is now regarded as identical with *Gnathostoma spinigerum* of Old World carnivores. The opossum harbors a large species, *G. didelphis,* which has been reported from Louisiana and Texas. A new species, smaller than *didelphis,* has now been found in a high percentage of raccoons in east Texas. The body scales of these gnathostomes present the best differential characters. They differ in area of body covered, general size and shape, number of points on scales at different levels of the body, and most strikingly in their method of dwindling away posteriorly. In *spinigerum* the scales become single, widely scattered spines about 25 to 40 μ long; in *didelphis* they become minute scattered spines only about 10 μ long, and in the gnathostome of the raccoon they fuse into transverse serrated ridges.

51. *Demonstration of a New Parasitic Nematode from a Water Scavenger Beetle.* A. C. Todd, University of Nebraska.

Thirty-one adult female and 26 adult male nematodes were recovered from the water scavenger beetle, *Tropisternus nimbatus* Say. (The beetles were obtained through the courtesy of Mr. M. J. Harbaugh.) The new nematodes appear to be congeneric with *Oxyuris* (*Helicothrix*) *hydroi* described by Galeb in 1878 from *Hydrous caraboides.* Interesting features of the worms are the prominence of the anterior lip of the vulva and the coiled filament which surrounds the egg.

52. *The Host-Parasite Phylogenetic Complex: The Criteria and Their Application to the Opalinid-Anuran Complex.* John Luther Mohr, University of California.

The proof of parallel evolution of parasite and host groups rests upon positive identification of parasite and host species. It is therefore desirable to use groups with obvious specific characters. Materials must be in good condition. Samples must be numerous and scattered evenly taxonomically, ecologically, and geographically. Other possible hosts must be sought in the same ecological niche and in animals related to known host groups. If on the basis of population surveys there seems to be evidence of host-parasite specificity, one should investigate limiting factors and the possibilities of making experimental transfers of parasites to hosts closely and distantly related to the wild hosts.

With a body of positive evidence of rigid host specificity from both survey and experimental sources, one may examine the host and parasite series to determine which forms are primitive and which, derivative. If this can be determined satisfactorily in both series, he should see whether primitive parasites inhabit primitive hosts, etc. If there is such coincidence, one may conclude that the groups probably evolved pari passu.

Studies on the opalinid-anuran complex have been deficient because of poorly preserved materials, insufficient numbers, and poorly distributed sampling. Experimental studies have been inadequate and opalinid and anuran phylogenies have been carelessly drawn (by the workers on the parasites). A phylogenetic parallelism has not been demonstrated for this complex.

53. *Some Observations on* Histomonas *from Wild Pheasants and Domestic Fowls.* D. H. Wenrich, University of Pennsylvania.

Measurements of 200 histomonads on prepared slides from ceca of two wild ring-necked pheasants (*Phasianus torquatus*) gave a range of diameter from 9.5 to 19.5 microns with an average of 13.9 microns. Larger individuals up to 27 microns in diameter were seen. Most showed 4 flagella arising from a pair of basal granules; a rhizostyle extended inwards along one side of the nucleus. A hyaline ectosarc was characteristic. About 12 per cent of histomonads from one pheasant showed a tubular or cylindrical extension from the surface, differentiated from the endosarc and covered by a layer of ectosarc and the surface membrane. Extensions

varied in width from 1 to 4 microns, and in length up to more than the cell diameter often with internal components which were equally long. They occurred at any point on the periphery and usually had one or more bacteria or other small bodies in a concavity at the outer end. Bacteria and filaments were ingested without the formation of such extensions. On slides from domestic fowls kindly supplied by Dr. E. E. Tyzzer, similar differentiations were seen. Possible interpretations: 1) a peculiar type of pseudopodium; 2) an attachment organelle (cf. the rostellum of oxymonad flagellates); 3) an ingestion tube.

On Tyzzer's slides his description of *Histomonas meleagridis* was largely confirmed, most of the individuals being considerably smaller than those in the pheasants and each bearing one flagellum or none. Tyzzer's "giants" with 4 flagella apparently correspond to the majority of individuals seen from the pheasants.

54. *The Pathogenicity for Kittens of* Endamoeba histolytica *from a Human Case of Acute Amoebic Dysentery.* CHARLES W. REES AND LUCY V. REARDON, National Institute of Health.

No abstract received.

55. *Pantothenic Acid and* Eimeria nieschulzi *Infection in the White Rat.* ELERY R. BECKER, Iowa State College.

Previously reported experiments have disclosed that when tests of the coccidium-growth-promoting potency of certain pure synthetic vitamins were made by employing them as supplements to a particular standard ration low in vitamin content, vitamin $B_1$ moderately depressed oöcyst counts, vitamin $B_6$ markedly increased them, while these two vitamins together produced an exceedingly marked depression of the numbers of oöcysts eliminated. The new studies are concerned with the effects of crystalline synthetic pantothenic acid supplements to a standard ration rather similar to that previously used. Pantothenic acid supplement alone enhances moderately the numbers of oöcysts eliminated. When, however, the control series of rats receives both the standard ration and pantothenic acid, test rats receiving the same regimen plus vitamins $B_1$ and $B_6$ do not, apparently, eliminate fewer oöcysts during the infection. Pantothenic acid in some way interferes with the coccidium-growth-depressing action of vitamin $B_1$ and vitamin $B_6$ fed together.

56. *Transmission of the Liver Coccidium,* Eimeria stiedae, *from the Domestic to the Cottontail Rabbit.* HARRY A. JANKIEWICZ, University of Southern California.

A preliminary examination of 5 young cottontails, *Sylvilagus audubonii vallicola,* from the San Joaquin area demonstrated no liver coccidiosis. Three cottontails were then orally inoculated with sporulated oöcysts of *E. stiedae* from domestic rabbits. Two received 7,500 oöcysts each on one day and 4,500 oöcysts on the following day. The third received 8,000 oöcysts on one day and a similar dosage two days later. Oöcysts of *E. stiedae* first appeared in the feces 18 days after inoculation. Upon autopsy 18 to 24 days after inoculation, the gall bladders and bile ducts of all three cottontails harbored oöcysts of *E. stiedae* morphologically and physiologically identical with those originally employed. One liver was very lightly infected the second more heavily infected, and the third very heavily infected. Two cottontails used as controls remained negative. Sporulated oöcysts from the heavily infected liver were fed to another cottontail on three successive days, 2,300 given daily. Eighteen days later, oöcysts of *E. stiedae* appeared in the feces and autopsy on the 20th day revealed a small number of oöcysts of *E. stiedae* in the bile fluid. The pathological findings are similar in both domestic and cottontail rabbits. Four squirrels, *Citellus beechyi,* given 8,000 oöcysts of *E. stiedae* from the domestic rabbit remained negative. Three of those inoculated mechanically carried oöcysts of *E. stiedae* through their digestive tracts 1 to 4 days after inoculation.

57. *Life Cycles of Four Species of Intestinal Coccidia of the Domestic Rabbit.* ROBERT L. RUTHERFORD AND JOHN F. KESSEL, University of Southern California.

The endogenous cycles of four intestinal species of *Eimeria*, i.e., *E. irresidua*, *E. magna*, *E. media*, and *E. perforans* have been studied in the domestic rabbit. Each species produces two types of merozoites. They are designated as Type "A" and Type "B," each producing a first and second generation of merozoites. It is possible that the first generation of Type "A" merozoites gives rise to microgametocytes or a second generation of merozoites, while Type "B" gives rise to macrogametocytes or a second generation of Type "B" merozoites. The four species require the following lengths of time for completion of their endogenous cycles: *E. irresidua*, 9 to 10 days; *E. magna*, 7 days; *E. media*, 6 days, and *E. perforans*, 5 days.

58. *A Study of the Paroxysms Resulting from Induced Infections of* Plasmodium vivax. G. Robert Coatney and Martin D. Young, U. S. Public Health Service.

Three hundred and thirty-eight paroxysms were studied in 21 white male neurosyphilitics infected with the St. Elizabeth strain of *Plasmodium vivax*. Chills occurred in only 201 (59 per cent) of the paroxysms. The absence of chills in 41 per cent of these attacks, together with the fact that chills do not occur in 76 per cent of the quartan malaria paroxysms in Negro paretics, indicates that the term "chills and fever" inadequately describes a malarial paroxysm. The temperature was already elevated at the start of the chill, averaging 100.6° F. The average length of the chill was 39 minutes and the average temperature rise during this phenomenon was 2.3° F. The average measurements for the 338 paroxysms were: time from onset of fever (100° F) to fever-peak, 3 hours, 52 minutes; time from fever-peak to end of fever, 6 hours, 18 minutes; fever-peak, 104.8° F. The duration of the temperature of 100° F and above averaged 10 hours, 10 minutes per paroxysm. Using this as a measure, the total hours of fever experienced by a white paretic undergoing malaria therapy with the St. Elizabeth strain of *P. vivax* can be estimated by multiplying the number of paroxysms by ten.

The 201 chill-accompanied paroxysms were compared with the 137 paroxysms without chills. The fever-peak average was 0.7° F higher in the chill-group and this difference was found to be statistically significant (6.26). Also, the average duration of the fever was 2 hours and 2 minutes shorter in the chill-accompanied group, but this difference is considered of doubtful statistical significance. The average rate of fever rise was 3.3 times faster during the chill (1° F in 17 minutes), than during any other period of fever rise (1° F in 56 minutes). It seems that the occurrence of a chill is directly responsible for the more rapid temperature rise and the higher peak temperature in the chill-accompanied paroxysm.

59. *Saurian Malaria.* Clay G. Huff, University of Chicago.

Natural infections of *Plasmodium* were found in numerous lizards of the species *Sceloporus f. ferrariperezi* and in occasional specimens of *S. m. microlepidotus* and *Basiliscus vittatus* from Mexico, and commonly in *Sceloporus u. undulatus* from Florida. The latter has been transferred by blood to collared lizards (*Crotaphytus collaris*), leopard lizards (*C. wislizenii*) and anoles (*Anolis carolinensis*). Other species (*Cnemidophorus t. tessellatus, Phrynosoma coronatum* and *P. orbiculare*) have been refractory to infection. *Culex pipiens* and *Aëdes aegypti* fed readily on *S. undulatus* and one nearly mature oöcyst was found on the stomach of an *A. aegypti* which had fed on an infected lizard. No evidence for the existence of exoerythrocytic schizogony was discovered in any of the natural or experimental infections. While it is believed that more than one species are represented in our laboratory infections, no identification or description will be made until extensive studies have been completed.

60. *Blood-cell Counts in* Plasmodium durae *Infections.* Carlton M. Herman and Jeanne Young, Los Angeles Wildlife Disease Research Station.

Because of the wide variation in blood-cell counts in normal birds, a single low R.B.C. count cannot be considered diagnostic of infection. In normal control

turkeys the R.B.C. counts varied from 1,990,000 to 2,570,000 per cmm of blood from one bird and from 1,448,000 to 2,984,000 from another. The white cell counts varied from 20,800 to 29,500 per cmm of blood and from 13,800 to 34,800, respectively, from the same two birds. In the six turkeys inoculated with *Plasmodium durae* the lowest count obtained was 1,248,000 R.B.C. Examinations were made at intervals of two and three days. In general the R.B.C. counts tended to drop with the appearance of over 100 parasites per 10,000 R.B.C. and remain at an average lower level until death or recovery. No apparent correlation was evident between parasite counts and individual R.B.C. counts, although the lower trend of the R.B.C. counts was much more pronounced and sustained in the infections with greater numbers of parasites. The changes in the W.B.C. counts were usually more marked, tending to be higher during infection and reaching 78,800 in one bird just before the peak of the patent period; however, the trend phenomenon was not as pronounced. Similar results were obtained with *P. durae* infections in Pekin ducks and in California Valley quail.

61. *The Anti-malarial Effect of Acranil.* Wendell D. Gingrich and Rollin S. Fillmore, School of Medicine, University of Texas.

Acranil, chemically related to atabrine, was tested prophylactically and curatively with infections of *Plasmodium cathemerium* in canaries. A series of 30 birds was inoculated intramuscularly with pooled infected blood. In 5 of these which had received 2 mg in 0.1 ml 5 per cent gelatin daily by stomach tube for 5 days, previous to inoculation, the incubation period averaged 10.4 days; whereas the incubation period averaged 4 days in the 5 controls. The blood examinations became negative in 3.4 days in 5 birds treated with 2 mg acranil daily for 5 days after the initial acute infection had developed, and in 4 days in 5 birds similarly treated with atabrine. In 5 birds of the same series the daily administration of 2 mg of acranil for 10 days immediately following inoculation delayed the appearance of parasites in the blood for 20.6 days, whereas similar treatment with atabrine delayed the appearance of parasites for more than 25 days.

62. *Reservoir Hosts of Chagas' Disease in the State of Texas.* A. Packchanian, School of Medicine, University of Texas.

A number of small mammals were collected in the state of Texas (armadillos, mice, and wood-rats around Three Rivers, Texas; opossum around Austin, Texas). Of these one nine-banded armadillo (*Dasypus novemcinctus*); 8 opossums (*Didelphys virginiana*), two house mice (*Mus musculus*), 32 wood-rats (*Neotoma micropus micropus*) were found naturally infected with *Trypanosoma cruzi*.

63. *The Occurrence of* Heterodoxus longitarsus *Piaget (Mallophaga: Boopinae) on Dogs in Mississippi.* J. W. Ward, Mississippi State College.

*Heterodoxus longitarsus* Piaget, a biting louse, was found to be present on 7 out of 40 dogs examined at this College during the past 10 years. These interesting specimens belong to the family Menoponidae, the most of which infest birds. Members of one small sub-family, the Boopinae, originally were parasites infesting marsupials in Australia. *H. longitarsus* has been reported from the dog twice from Africa (one of which is a personal communication from Dr. Rene du Toit), once from Formosa, once from San Francisco, and once from Oklahoma. It is interesting to note that this parasite, which had as its original host a mammal that is at the lowest end of the phylogenetic scale and was once restricted to a small section of the world, now seems to have established itself on mammals near the other end of the phylogenetic scale and has become distributed throughout the world.

64. *Mechanical Transmission of Shope Rabbit Fibroma by Certain Haematophagous Bugs.* Cornelius B. Philip, Hamilton, Montana.

Mechanical transfer of fibroma virus between a donor domestic hare, and 2 test hares each by interrupted feedings and injection of 3 species of Triatomidae was

successful as judged by resistance of test animals to subsequent challenge doses of controlled myxoma virus. Three of these had shown small local lesions following test, while one bitten animal was without any visible reaction at the site of attack. The donor was used on the fourth and seventh days after it was infected. On the other hand, animals tested by injection and feeding of "incubated" insects succumbed in the usual way when infected with myxoma virus later.

65. *Oxidation-reduction Potentials in Relation to the Cultivation of* Endamoeba histolytica. Leon Jacobs, National Institute of Health.

Potential-time curves have been obtained on pure cultures of each of the following bacteria: *Leptotrichia buccalis, Clostridium welchii, Streptococcus hemolyticus, Bacillus subtilis* and *Bacterium coronafaciens.* A rapid drop in the potential of the medium to an average minimum of −336 mv occurs with *L. buccalis* and to −500 mv with *Cl. welchii,* levels which are reached within the first 10 hours. The potentials hover around the minimum for 24 to 40 hours, then exhibit a more or less gradual return to positive levels. A minimum of −114 to −150 mv is attained after 25 hours of cultivation of *S. hemolyticus* and *B. subtilis* and after 72 hours with *B. coronafaciens;* this potential is maintained for up to 3 weeks.

Cultures of *E. histolytica* with *L. buccalis* or *Cl. welchii* show abundant growth but require transplants after 4 or 5 days for best results, while with the other organisms the amoebae persist in the same tube for up to 3 weeks. Although excystation and growth of amoebae will take place at a potential of −114 to −150 mv, growth is more prolific at −300 to −500 mv. Also, the longevity of amoeba cultures is correlated with the maintenance of reducing potentials. These data explain the success of Snyder and Meleney in securing excystation with cysteine HCl, which produces a potential of −160 to −200 mv in the concentration used by them. The data also indicate that the cultivation of *E. histolytica* without bacteria will require control of the oxidation-reduction potentials of the medium, a heretofore neglected factor.

66. *Indicanuria and the Vitamin A Absorption Test in Giardiasis.* C. P. Katsampes, W. A. Phillips, A. B. McCoord and S. T. Harris, University of Rochester.

In a series of 15 cases showing *Giardia* cysts in the stool associated with mild or severe upper abdominal pain, 12, or 80 per cent, had indicanuria. In 6 of the 12 cases, a duodenal drainage was also done and in every case the trophozoites of *Giardia lamblia* were found in the duodenal contents. The presence of detoxified indole (indican) in the urine of such cases suggests the possibility of interference by the parasite with protein absorption in the upper intestinal tract.

In 3 cases so far studied, a marked decrease in the rate and degree of fat absorption was detected by the vitamin A absorption test. Ten to 14 days after treatment with atabrine, when the stool and duodenal contents showed no *Giardia,* in all cases a moderate but definite improvement in fat absorption was found. In one case, a repeat test 16 days later showed a very marked improvement in fat absorption. In another of the 3 cases, the cysts reappeared in the stool associated with indicanuria and abdominal pain 5 months after the previous atabrine treatment, and the absorption test results remained well below the normal average. The results with this test so far appear to bear out the contention of Veghelyi (1940) that giardiasis interferes with fat absorption.

67. *Incidence of Protozoan Infection amongst the Personnel of a Large General Hospital with Special Regard to Incidence according to Race and Occupation.* Maurice M. Rothman and Marion Laskey, University of Pennsylvania.

A protozoan survey was made of the personnel and staff at the Graduate Hospital of the University of Pennsylvania. Included amongst them were the internes, nurses, nurses' aides, porters, orderlies, maids, elevator operators, and those from the diet kitchen, laboratory, record room, administration office and x-ray depart-

[illegible] A questionnaire requesting [illegible] parasitic, personal past medical history, and present symptoms if any, accompanied each specimen submitted. Each of the authors subsequently examined all of the material by fresh wet preparations and stained slides. A total of 307 individuals submitted specimens. This number was then sub-divided into groups, the males and the females. The incidence of infection as a whole is reviewed as well as the incidence of infection within the various groups.

98. Survival Time of Gastrointestinal Helminths Exposed to Sunlight. Eugene M. Sprague, University of Pennsylvania, and L. G. Rice (introduced by Hugh Cutler), Bucknell Junior College, Pennsylvania.

Helminths normally occurring in the human intestine, ought not be expected to survive the passage of 12 hours, 48 hours after excretion. 144 hours, 10 days, 20 days, 30 days, and 40 days after excretion. 144 hours, 10 days, 20 days, 30 days, and 40 days after excretion. Seven groups were exposed, the ova of *T. trichiura* and *A. lumbricoides* were examined after a 24-hour interval. One specimen for *T. trichiura* was still positive for *T. trichiura*. [illegible] Ova were examined as follows: [illegible] [illegible] [illegible]

that they constitute a lucrative and non-specific medium. Furthermore, Lincicome (1936, J. Parasitol. 22: 54–59) reviewed the development of the larvae of *Dracunculus insignis* in snail embryos. The nematodes were reported to a considerable depth in the water in a closed system after which they were recovered especially well in the snail embryos. The nematodes were never successfully freed of bacteria or fungi by the antiseptic methods but 50 embryos lived 3 days or more after inoculation, and 4 hatched. Eight embryos were sectioned and three of these did not show evidence for developing nematodes but all were negative. Observations indicated that the nematodes did not penetrate the tissues of the embryo. Larvae were then placed in saline extracts of normal snail embryos of various ages. The nematodes remained unaffected if retained the free-living character but longer than two hours in extracts of embryos not more than 17 days old. In extracts of such embryos 18 days old or older the nematodes were immobilized and killed in less than two hours. It is suggested that snail embryos less than 18 days old do not possess substances necessary to stimulate the development of the nematode but that on about the 18th day a substance(s) develops which is capable of killing the nematode rapidly.

*71. Studies on Host-Parasite Reactions. VI. An Hypothesis to Account for Pigmented Granulomata Formed by Fish.* Everett W. Stevens, III, Wesleyan University.

Several years ago a program centering around a study of larval parasite-host reactions in fish was initiated with the hope of expounding the underlying differences noted in host reactions between adult hosts penetrating parasite as the Serpulidae, Thaumastodon and Fibricolidae. After the life cycles were known the next step involved an investigation of the types in their marriage relations. In this way the metacercarial cysts of *C. cuticulatus* (Leptorhynchoides thecatus (Linton), pathogenic and transmitted to fishes have been described, using special emphasis on the tissue reaction. The cyst of *Cryptocotyle lingua* is now being examined.

Possibly the relationship between the parasite (*C. lingua*) and its intermediate host, the mollusk (*T. obsoletus*) has been studied with the hope of determining the mechanism involved in the penetration and deposition of pigment in the tentacle bearing cells that surround the parasite cyst. Cyst and normal melanophores were compared by various physiological means while the overlying mechanism of normally pigmented cells were studied to furnish a further basis for comparison. From results of these studies the following hypothesis is presented to account for the formation of pigment cells about the cyst. It is known that melanin is produced as the result of a series of complex chemical reactions involving for example an enzyme such as tyrosinase and the chromogen, tyrosine. It is suggested that certain cells of the host system lack a necessary enzyme but lack the chromogen. The parasite at the time of penetration for directly afterwards supplies the necessary substance for pigment production thus accounting for the characteristically melanized cysts. The desire of pigment bearing cells about some cysts (as *Clinostomum*) may be due to the absence of the necessary chromogen in the parasite. Further evidence is being sought on these points.

*72. Comparisons in the Prevalence of Nematodes in Clupeoid Fishes in Atlantic Waters.* Eli W. Stunkard, University of Nebraska.

Comparisons are made of nematodes of the sardine, *Clupanodon pilchardus*, from Portugal, Florida (about 100 species), and from the tropical American Pacific (82 species), and of nematodes reported from Bermuda (about 30 species) and from Woods Hole (about 70 species). Assuming that the host samples compared have been so sampled as to furnish a representative segment for comparison with the Bermuda region, a few pronounced similarities and dissimilarities among these regions are suggested. In spite of incompleteness of the data it seems safe to conclude the following: (1) Bermuda nematodes are remarkably similar to those of Portugal and rather distant from nematodes at Woods Hole. (2) Nematodes of the tropical American Pacific have a pronounced similarity to the Florida fauna (over 25 per

cent identical). (3) Woods Hole trematodes show pronounced Arctic and also Beaufort, North Carolina, connections and about 12 per cent identity with Tortugas species. (4) The distribution picture can be largely explained by oceanic currents and temperatures, past and present. (5) Because of their abundance and variety the digenetic trematodes constitute a favorable group for distribution studies.

73. *The Frequency of Helminths in Their Naturally Infected Hosts.* H. F. Hsü and S. Y. Li, Peiping Union Medical College, Peiping, China.

No abstract received.

74. *Further Studies on the North American Hirudinea.* Marvin C. Meyer, New Jersey College for Women of Rutgers University.

Our knowledge of the North American fresh-water Hirudinea fauna is so meager that any definite distribution and host record is of considerable importance. Various collections, especially Piscicolidae, received for identification have yielded specimens from remote localities and new hosts. It has been shown that certain species of fresh-water fish leeches may occur in epidemic proportions and may even appreciably affect the yield of economically important fish. Consideration will be given to host-parasite specificity among the Piscicolidae. Several instances of a glossiphonid infecting the buccal cavity of waterfowl together with its effect will also be discussed.

75. *A New Species of Branchiobdellid from Kentucky.* Clarence J. Goodnight, Brooklyn College.

In the examination of a collection of branchiobdellids from near Lexington, Kentucky, a new species was encountered. This new worm was a member of the common eastern genus *Cambarincola* Ellis. It is apparently a form of local distribution, since it was not encountered in collections from other localities in Kentucky. This worm lived on the crayfish, *Cambarus bartoni.* This record gives further evidence to the theory that while most species of branchiobdellids are widely distributed, a few forms are quite local.

76. *Life History and Development of* Macracanthorhynchus ingens *and* Mediorhynchus grandis (*Acanthocephala*). Donald V. Moore, Rice Institute.

Eggs of *Macracanthorhynchus ingens* from the raccoon, *Procyon lotor,* were fed to grubs of *Phyllophaga crinita.* Hatching in the gut of the grub the acanthor penetrates into the hemocoele where after 60–70 days the encysted acanthella may be found. The acanthor is covered with cuticular spines, and has 3 pairs of rostellar hooks. Thirty to 35 days after infection the larvae may be found attached to the outer wall of the gut. By this time the anlagen of various adult structures may be identified in the central nuclear mass. The elongate pre-acanthella stage has a ring of 6 nuclei in the apical ring of the proboscis, and 14 nuclei in the lemniscal ring, of which 7 migrate into each lemniscus. The acanthella with the proboscis invaginated, which is characteristic of the infective stage, is enveloped by a hyaline fusiform cyst, one cell layer thick, which develops from the outermost layer of the larva.

Eggs of *Mediorhynchus grandis* from the meadowlark, *Sturnella magna,* were found to develop in grasshoppers, *Chortophaga viridifasciata australior, Orphuella pelidna* and *Arphia luteola.* The acanthor were found on the exterior of the gut wall 10–12 days after infection and the infective larvae developed in the hemocoele of the grasshoppers in 25–30 days. The acanthor is spined and has 3 pairs of rostellar hooks. There are 6 nuclei in the apical ring of the proboscis and 12 nuclei in the lemniscal ring. The acanthella with the proboscis invaginated, is enveloped by a cyst similar in structure to the cyst of *Macracanthorhynchus ingens,* but is ellipsoid in shape.

77. *An Addition to the Life History of* Leidynema appendiculatum (*Leidy, 1850*) *Chitwood, 1932, a Nematode Parasitic in Cockroaches.* A. C. Todd, University of Nebraska.

Observations on the development of the egg of *Leidynema appendiculatum* have been made during the course of some hatching experiments. These experiments show that two molts occur within the egg during the development of the larva. Under natural conditions the first molt occurs outside the host and results in the establishment of a resting stage which is infective for the roach hosts. The second molt occurs, under natural conditions, inside the roach; it can be demonstrated in vitro by treating infective eggs with dilute protein solutions.

78. *Removal of Chicken Tapeworms by Host Starvation and Some Effects of Such Treatment on Tapeworm Metabolism.* W. M. Reid, Monmouth College, and J. E. Ackert, Kansas State College.

The loss of strobilae of *Raillietina cesticillus* after 24 to 48 hours of host starvation (Reid, 1940, J. Parasitol. **26** Suppl: 16) suggested the use of starvation in tapeworm control. However, the fact that some scolices were retained in the gut for as much as three weeks of starvation, new strobilae being subsequently regenerated, makes such a procedure impractical. This starvation effect is probably the essential factor in various "treatments" suggested to poultry producers. A claim that treatment may be effected by limiting the diet to oats for a few days appears to be based entirely on concomitant starvation effects. Under experimental conditions substitution of oats for the normal ration resulted in partial or complete voluntary host starvation for one or two days together with the elimination of strobilae. Later, when the oats were taken in quantity, the worms were again able to develop gravid proglottids. Further studies on the chemical composition of worms removed from the gut of feeding fowls as compared with worms from fowls which had been off feed for 20 hours showed no significant change in fat content but a relative rise in nitrogen and water. These findings substantiate the view that the loss of strobilae in starvation is due primarily to depletion in the glycogen reserve to such an extent that muscular energy is no longer available for the worms to maintain their positions.

79. *Effect of Atabrine upon Experimental Cysticercosis of Mice.* James T. Culbertson and Sylvia H. Greenfield, Columbia University.

Thirty-two mice were fed 500 onchospheres of *Taenia taeniaeformis.* Twenty-two of the animals were treated with 5 mg of atabrine for two days before infection, and thereafter on alternate days during the ensuing four weeks. The treated animals and the controls were then autopsied and the cysticerci on the surfaces of their livers were counted. At autopsy, all the control mice were heavily infected, an average of 119.9 living cysts and 9.2 dead cysts being counted. Among the 22 treated animals, an average of 12.7 living cysts and 23.7 dead cysts were found. No living cysts whatsoever were found in 11 of the treated mice. It thus appears that the development of *Cysticercus fasciolaris* in mice is prevented or retarded by the administration of large doses of atabrine.

80. *The Life Cycle of* Dioctophyma renale, *the Giant Kidney Worm of Mammals.* Arthur E. Woodhead, University of Michigan.

Eggs of *D. renale* will hatch in the intestine of branchiobdellids. Movement begins in one minute, hatching is finished in five minutes, and penetration into the body cavity is finished in 15 minutes. At about the 10th day the anterior third of the larva swells and the three pharynx lobes, with chitinous elongations, begin to form. Cephalic papillae are plainly seen. Later the larva begins to coil the posterior two-thirds and the body cells increasing in number hide internal development. At six weeks the coiled larva is forming a tightly coiled cyst. Its great similarity to the cyst of *Paragordius* is startling. It is evident that the life cycle of *D. renale* has been concealed by this close similarity. Only in the manner of coiling of the posterior third, can the two cysts be distinguished.

Numerous cysts of *Paragordius* are found in branchiobdellids and we have also found a larva of *D. renale* in the body cavity. The number of *D. renale* cysts occurring in nature appears to be small. Crickets which serve as second intermediate hosts for *Paragordius* are found also to contain a larval form with elongated body

and a retracted head organ of the *D. renale-Paragordius* type. In specimens up to 20 mm there appears to be no degeneration of the head structures. This size larva and its head organs would suit conditions for penetration required of a *D. renale* larva. Feeding experiments are in progress to determine if this form is the larva of *D. renale*.

81. *The Possibility of Chemical Control of the Snail Intermediate Hosts of* Schistosoma mansoni *in Venezuela.* George W. Luttermoser. Instituto Nacional de Higiene, Caracas, Venezuela.

A comparison was made of the efficacy of copper carbonate and solutions of recently slaked lime for killing the common snail intermediate hosts of *Schistosoma mansoni* in Venezuela. A 1 : 1,000 solution of lime or a 1 : 10,000 solution of copper carbonate killed all these snails in 48 hours. In the presence of soil, a greater concentration of both chemicals was necessary, i.e., at least 190 grams of lime per square meter of water area or about a 3 : 1,000 solution. The use of the lime is recommended, because in solution it also killed the miracidia and cercariae of *S. mansoni;* it is strongly bactericidal; and it proved nontoxic to rats, mice, a dog, a monkey and a calf. Furthermore, lime is readily available, is much cheaper and much easier to use and may help to neutralize the soil which is acid along many irrigation canals in Venezuela.

Of five typical areas selected for field-test, three were parts of irrigation canals, and the other two were water reservoirs. Movement of snails into or out of these areas was prevented by screen doors. Two days before and after the lime treatment in each region, collections of 200 or more snails were made and if they did not respond within 48 hours to favorable conditions or to different stimuli, they were called "dead." Some of each collection were dissected. Before any treatment, 93, 100, 100, 97 and 55 per cent were alive. After two applications of lime, about 14 days apart, the snails were all killed in two of the five areas, while in the other three areas the percentage of living snails was reduced to 2, 1, 2, 5, and 2 per cent.

82. *Effects of Duodenal Mucus of Dogs and Swine upon the Viability of* Ascaridia lineata *in Vitro.* L. L. Eisenbrandt, University of Kansas City, and J. E. Ackert, Kansas State College.

Ackert, Edgar and Frick (1939) showed that a saline extract of the chicken intestinal mucosa did not kill the chicken nematode, *Ascaridia lineata,* when cultured in vitro. Similar studies were made upon the viability of 349 nematodes of the same species using duodenal mucus extract of dog and of hog. Control worms were placed in a nutrient salt solution. The mortality of *A. lineata* cultured in dog mucus extract was: 24 hours, 35 per cent; 48 hours, 96 per cent and 72 hours, 100 per cent. The death rate of control worms for the same respective periods was: 3 per cent, 8 per cent and 17 per cent. Essentially the same results were obtained with hog duodenal mucus extract; the mortality at 24, 48 and 72 hours was: 0 per cent, 81 per cent and 100 per cent. During the same periods control worms died as follows: 0 per cent, 0 per cent and 28 per cent. Some of these worms lived for a week in the nutrient medium. The difference between the mortality rate of the experimental worms and the control worms in both groups for each period was statistically significant. Therefore, mucus extracts of both dog and hog caused the early death of all the fowl nematodes tested. This may suggest that the host specificity of *Ascaridia lineata* is attributed, in part, to duodenal mucus.

83. *The Rôle of Duodenal Mucus in Age Resistance.* L. P. Frick and J. E. Ackert, Kansas State College.

On the basis of the close relationship exhibited between the increase in the number of goblet cells in the intestine of older chickens and the development of an age resistance in chickens to the fowl nematode, *Ascaridia galli,* there was reason to believe that some substance might be secreted with the mucus from the duodenal goblet cells which might be instrumental in the development of the age resistance.

Data obtained from tests in which *A. galli* were cultured in vitro in the presence of duodenal mucus from resistant chickens indicated that this mucus had the ability to inhibit the growth of the worms. Furthermore, it was shown that the active agent in the mucus was thermostable. These tests were repeated using numbers of samples large enough for statistical treatment. *A. galli* from 30 to 90 days of age taken by 10-day intervals were treated with mucus from chickens 60 to 140 days of age considered by 20-day intervals. The mucus used in these tests was not treated with heat before use.

The data in this series of experiments when analyzed by analysis of variance yielded the highly significant F value of 6.35. It has thus been demonstrated that the duodenal mucus samples differed significantly in their ability to inhibit the growth of the nematodes, and that the effectiveness of the mucus as a growth inhibitor varied directly with the age of the chickens from which the mucus was taken.

84. *Intestinal Resistance to a Second Infection of* Trichinella spiralis. Arthur J. Levin and Titus C. Evans, University of Iowa.

As previously reported (Levin and Evans, 1940, J. Parasitol. **26** Suppl: 31), it was possible to treat *Trichinella spiralis* larvae with roentgen radiation (3250–3750r) which inhibited the development of offspring without preventing the maturation of the larvae in the intestine of the host. In this way, irradiated larvae established an intestinal infection in rats without the usual consequent muscle phase. The next step was to determine whether an intestinal infection of *T. spiralis*, without the resulting muscle invasion, would grant host resistance to subsequent *Trichinella* infections. Therefore, 3 groups of rats were infected with irradiated (3250r, 3500r, and 3750r) larvae. The first group was re-infected with normal larvae after two weeks, the second group after 3 weeks, and the third after 4 weeks. Three rats, of each group, were re-infected with a dose of 2,500 larvae and three were re-infected with a heavier dose (10,000 larvae). Two months after the last rat was re-infected, all of the rats were killed and larval counts were made. The control rats (untreated) gave larvae-larvae ratios of 42.81 (heavy infection) and 66.00 (lighter infection). The 18 treated rats gave an average ratio of 0.49, with one extreme case of 12.50. The treated rats were as resistant to heavy re-infection doses as they were to lighter ones.

85. *Demonstration of Naturally Acquired, Passive Immunity to* Hymenolepis nana *var.* fraterna. John E. Larsh, Jr., Johns Hopkins University.

Passive transfer of immunity from mother mice to their offspring has been demonstrated for the cestode, *Hymenolepis nana* var. *fraterna*. At the time of weaning (around 21 days), mice born of an infected mother showed an average of about 0.7 per cent development of cysticercoids from a test infection, in contrast to an average of at least 6 per cent in the young of uninfected mothers. This resistance to infection persists for about 38 to 40 days. The immunity is passively transferred from mother to offspring both in utero and in the milk. That received in utero is ephemeral and of slight significance compared with that obtained from the milk. Infected and uninfected mothers were exchanged immediately after the young were born, so that an infected mouse would raise the litter born of an uninfected mouse, and vice versa. When these young were infected 21 days after birth, those which were protected by the milk alone showed a percentage development of cysticercoids of about 0.7 per cent; those which received protection only in utero about 1.6 per cent; and the controls about 6 per cent. When mice were infected after parturition, it was found that the offspring were as well protected as those born of mothers which had been infected early in pregnancy. Mice that had lost their infection more than a month before conception were still capable of transmitting protective antibodies to their offspring. This demonstration of passive transfer of immunity from mother to offspring lends support to the evidence already available that an antibody is involved in immunity produced against this parasite.

86. *Effects of Testosterone on Nematodes.* Lyell J. Thomas, University of Illinois.

Nematodes of the genus *Rhabditis* were obtained from the body cavity of the carrion beetle *Necrophorus obicolis* at the University of Michigan Biological Station, August 18, 1940. These nematodes were cultured successfully and on April 25, 1941, a few crystals of testosterone were added to a culture (strain A). Worms were transferred from it to fresh culture media without testosterone, one month apart, in July, August and September, 1941, but all males examined showed the spicules to be fused from the distal end part way so as to form a V-shaped structure. Control cultures showed the males to have normally two equal spicules. On October 9, 1941, additional crystals of testosterone were given to the fused-spicule strain, and when examined October 20, 1941, all males examined had but a single large spicule. The females were overly large and either sterile or their egg production greatly reduced. This reaction to testosterone on the part of female nematodes is similar to that in the female mammal.

87. *Hairworms as Parasites of Fishes.* Ross F. Nigrelli, New York Aquarium. From April to July of the present year, several tropical, semi-tropical and temperate fresh-water fishes present in the exhibition tanks of the New York Aquarium were found infected with hairworms (Gordiacea). The small tropical and semi-tropical hosts, *Limia dominicensis* C. & V., *Poecilia vivipara* B. & S., *Poecilobrycon* sp., and *Platypoecilus maculatus* Günther, had bellies so distended that they found it difficult to swim or keep themselves right side up. On rupturing the belly wall a serous exudate was released. In all cases two active worms, male and female, varying in length from 65 mm to 215 mm, were found free in the body cavity and strongly coiled around each other. Further examination of the fishes showed that the organs were displaced and considerably damaged. The temperate fresh-water fishes, *Salmo irideus* Gibbons, *Salvelinus fontinalis* (Mitchill), and *Micropterus punctulatus* (Raf.), showed no belly enlargement, and, with the exception of *M. punctulatus* (Kentucky bass), two worms, male and female, measuring 125 mm and 135 mm respectively, had penetrated the sinus venosus resulting in a severe hemorrhage. All the worms were allocated to the genus *Chorodes* Creplin, 1847. Those found in the Kentucky bass and the trouts were definitely identified as *Chorodes morgani* Montgomery, 1898. Both males and females showed the characteristic distinction of the cuticular areoles and the caudal ends.

88. *Cultivation Experiments with the Avian Malaria,* Plasmodium circumflexum. Frederick Coulston, Syracuse University.

A cultivation method was sought that would keep the erythrocytes suitable for growth of the parasite, supply oxygen and carbon dioxide and permit agitation of the culture mixtures. Many types of containers were used. The best results were obtained with round-bottomed test tubes. These were bent almost at right angles, 3.5 cm from the bottom, and indented below the bend. Thus the end of the tube became a separate compartment communicating by a narrow opening with the upper portion. This shape helped preclude contamination and prevented the mixture from running up the sides of the tube. The agitator was mounted in an incubator (35–39° C). Agitation was controlled by a time clock. Good results were obtained with the following mixture: 1 part each of 1:1000 heparin, normal blood, heavily parasitized blood, and 2 parts Baker's tissue culture fluid. Baker's fluid is a buffered solution containing glucose with many of the essential proteins and vitamins. Sterile oxygen and carbon dioxide (5 per cent) were added by needle. Fresh erythrocytes were supplied daily.

*P. circumflexum* was grown for at least one asexual generation. In some experiments, of two weeks duration, possibly three and four generations developed. There was usually a definite increase in the number of parasites from the third to the seventh day. Good cultures, 1 to 13 days old, produced infections in canaries. Invasion of freshly supplied erythrocytes was easily demonstrated. After three days most large schizonts and segmenters were observed growing in remains of erythrocytes. Abundant pigment appeared associated with the characteristic vacuole. Occasionally the pigment was very refractile resembling *P. vaughani*. Gametocytes could be recognized for 7 days.

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* Deceased.

*List of Meeting Places*

| | | | | | |
|---|---|---|---|---|---|
| 1925 | Kansas City | 1930 | Cleveland | 1936 | Atlantic City |
| 1926 | Philadelphia | 1931 | New Orleans | 1937 | Indianapolis |
| 1927 | Nashville | 1932 | Atlantic City | 1938 | Richmond |
| 1928 | New York | 1933 | Boston | 1939 | Columbus |
| 1929 | Des Moines | 1934 | Pittsburgh | 1940 | Philadelphia |
| | | 1935 | St. Louis | | |

# CONSTITUTION OF THE AMERICAN SOCIETY OF PARASITOLOGISTS

(Including revisions of Dec. 30, 1931, Dec. 28, 1932, Dec. 29, 1933, and Dec. 31, 1940)

## NAME AND OBJECT

The name of the society is the American Society of Parasitologists.

The object of the society is the association of workers in the field of Parasitology for the presentation and discussion of new or important facts and problems in that science and for the adoption of such measures as will tend to the advancement of parasitological teaching and investigation in this country.

## MEMBERSHIP

The members of the society shall be of two classes, active and foreign honorary.

Any person interested in parasitology may be a candidate for active membership.

Any foreign scientist who has made eminent contribution to Parasitology may be eligible for honorary membership.

Candidates for membership shall be elected by the Council.

## OFFICERS

The officers of the society shall be a President and a Vice-President, who shall be elected for one year; a Secretary and a Treasurer, who shall be elected for two years; and members at large of the Council.

The Council shall consist of the President, the Vice-President, the Secretary, the Treasurer, and eight members elected by ballot from the society at large, two for four years, two for three years, two for two years and two for one year. After the first year, two members at large of the Council shall be elected each year to serve four years.

If any vacancy occurs among the officers, the Council is authorized to appoint a member to fill out the unexpired portion of the current year.

The routine business of the society shall be administered by the Council.

Five shall constitute a quorum of the Council.

## DUES

The dues, to include subscription to the JOURNAL OF PARASITOLOGY, shall be four dollars the year for active members, unless changed by vote of the society.

## MEETINGS

There shall be an annual meeting and such other scientific of business meetings as the Council shall determine.

During the annual meeting a business meeting will be held for the election of officers for the ensuing year and for the transaction of other business.

## JOURNAL OF PARASITOLOGY

This Journal, the property of the society, is its official organ. Responsibility for its conduct shall rest with the Council which shall select the editorial staff and set the price of subscription.

## ENDOWMENT FUND

Provision is made for the establishment of a permanent endowment fund, the principal of which may be expended only by a three-fourths vote of all members of the Council and approval by a three-fourths vote of the members of the society present at a regular meeting. The Council shall be entrusted with the maintenance of the fund, and the use of the income therefrom.

### AMENDMENT

On recommendation of a two-thirds vote of the Council, the constitution may be amended by a two-thirds vote of the members present at any regular business meeting of the society, provided that at least 30 days' notice has been given to the membership of the proposed amendment.

## BY-LAWS

### MEMBERSHIP

1. *Election of Members.* An affirmative vote of all Council members present at a meeting shall be necessary for the election of candidates for membership. If the vote is taken by mail ballot, an affirmative vote of all members of the Council replying within thirty days shall be required.

2. *Members in Good Standing.* Members in good standing are those whose current dues are paid.

3. *Delinquent Members.* The JOURNAL OF PARASITOLOGY shall not be sent to members in arrears, and members in arrears for the current year and two previous years shall be dropped from the roll of the society at the end of the current year.

4. *Reinstatement of Delinquent Members.* Members dropped for non-payment of dues, or who have resigned, may be reinstated by the payment of all dues in arrears. Otherwise, the applicant must apply for election as a new member.

5. *Non-subscribing Members.* Where a second membership in the society is taken in the same immediate family, the second member may join upon the payment of annual dues of one dollar, but without receiving the JOURNAL OF PARASITOLOGY.

6. *Honorary Life Members.* Upon unanimous vote, the Council may recommend that the society confer honorary life membership upon distinguished American parasitologists over sixty years of age. Honorary Life Members shall enjoy full membership privileges and shall be exempted from the payment of dues. The number of Honorary Life Members at any one time shall be limited to five.

7. *Foreign Honorary Members.* Upon unanimous vote, the Council at its annual meeting may elect Foreign Honorary Members. No two men from the same country shall be elected in the same year. The number of Foreign Honorary Members at any one time shall be limited to twelve. Foreign Honorary Members may receive the JOURNAL OF PARASITOLOGY upon payment of membership dues.

### PRESENTATION OF PAPERS AT ANNUAL MEETINGS

1. Except for invited papers, and papers coming to the American Society of Parasitologists program through joint sessions with another society or section, all persons presenting papers must be members of the society in good standing, or must be introduced by a member in good standing.

2. Each member of the society in good standing may be allotted not more than fifteen minutes of program time, to be used in person or by a non-member introduced by him. If the program is crowded, the maximal allotment of time may be reduced to ten minutes.

3. Papers offered for presentation too late to be included on the printed program may be presented at the conclusion of any of the scientific sessions provided that the presiding officer obtains the consent of the members present.

### OFFICERS

1. The Council shall act as a nominating committee and at the annual meeting shall submit to the society at least one nominee for each office to be filled. The Secretary shall invite the members of the society to submit nominations for consideration by the Council.

2. The Treasurer of the society shall act also as Treasurer for the JOURNAL OF PARASITOLOGY and shall be bonded for the sum of two thousand dollars.

3. A sum of fifty dollars shall be allotted annually to the Secretary, to the Treasurer, and to the Chairman of the Editorial Committee for attendance at the annual meeting.

MANAGEMENT OF THE JOURNAL OF PARASITOLOGY

1. The JOURNAL OF PARASITOLOGY, as the official organ of the society, shall be managed by an Editorial Committee appointed by the Council for a five-year period, and shall consist of one Protozoologist, one Helminthologist, and one Entomologist, one of whom shall be appointed by the Council to act as Chairman.

2. The Editorial Committee shall be assisted by an Editorial Board consisting of twelve members appointed by the Council for a four-year period in such a way that three members will retire and three new members shall be elected each year. The Editorial Board shall consist of two Entomologists, four Protozoologists, and six Helminthologists to be elected on the basis of attainment, interest in the society and geographical location.

3. The price of the JOURNAL OF PARASITOLOGY shall be five dollars per volume, except to members of the American Society of Parasitologists who shall receive it as a membership privilege included in the annual dues of four dollars.

ENDOWMENT FUND

1. Council shall select a Custodian of the Endowment Fund and two associates to whom it may delegate responsibility for management of the fund. The Custodian shall make an annual accounting to Council and such other reports as Council may request. The approval of two of the three custodians shall be necessary for the purchase, sale or exchange of securities. One of the three custodians shall be the Treasurer of the society and his signature shall be required on all vouchers of expenditure from the fund.

ADDITIONS AND AMENDMENTS

1. Additional by-laws may be created by a two-thirds vote of Council members present at a meeting, or by an affirmative vote of nine Council members in a ballot conducted by mail. By the same procedure existing by-laws may be repealed, amended, or suspended.